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PRELIMINARY ECONOMIC EVALUATION REPORT FOR SOIL CONTAMINANT REDUCTION AT OLD PLATING SHOP NAS JACKSONVILLE FL

3/1/1995

ABB ENVIRONMENTAL

PRELIMINARY ECONOMIC EVALUATION REPORT (PEER) FOR SOIL CONTAMINANT REDUCTION

OLD PLATING SHOP, BUILDING 101

NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Unit Identification Code (UIC): N00207

Contract No. N62467-89-D-0317/076

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GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
AM	Action Memorandum
atm-m^3/mol	atmosphere per cubic meters per molecule
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Procedure
DAF	Dilution/Attenuation Factor
FDEP	Florida Department of Environmental Protection
FFA	Federal Facility Agreement
f_{oc}	Content of Organic Carbon in Soil
g/g	grams per gram
IRP	Installation Restoration Program
K_d	Soil-water Partition Coefficient
kg/ℓ	kilogram per liter
K_{oc}	Carbon/Water Partition Coefficient
ℓ/kg	liters per kiloram
MCLG	maximum contaminant limit goal
mg/kg	milligrams per kilogram
mg/ℓ	milligrams per liter
NAS	Naval Air Station
NPL	National Priority List
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PEER	Preliminary Economic Evaluation Report
RAC	Remedial Action Contractor
RAG	Risk Assessment Guidance
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation and Feasibility Study
SARA	Superfund Amendments and Reauthorization Act
SOUTHNAVFACENGCOM	Southern Division, Naval Facilities Engineering Command
SSL	soil screening level
TAL	target analyte list
TCL	target compound list
USEPA	U.S. Environmental Protection Agency
yd^3	cubic yards

1.0 INTRODUCTION

This Preliminary Economic Evaluation Report (PEER) was prepared for the Old Plating Shop, Building 101, which is located within Operable Unit (OU) 3 at the Naval Air Station (NAS) Jacksonville, Jacksonville, Florida (Figure 1-1). The Old Plating Shop, Building 101, is located within the industrial area of NAS Jacksonville designated as OU 3 (Figures 1-2 and 1-3).

NAS Jacksonville was placed on the U.S. Environmental Protection Agency's (USEPA's) National Priority List (NPL) in December 1989. NAS Jacksonville is participating in the U.S. Department of Defense Installation Restoration Program (IRP), which identifies and remediates conditions related to past spills or disposal of hazardous wastes. The IRP complies with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA). These acts, passed by Congress in 1980 and 1986, respectively, establish the means to assess and clean up hazardous waste sites. In October 1990, a Federal Facility Agreement (FFA) was signed by the USEPA, the Florida Department of Environmental Protection (FDEP), and the Navy to coordinate IRP actions at NAS Jacksonville.

1.1 PURPOSE AND SCOPE. Remedial action at the Old Plating Shop, Building 101, was first oriented to satisfy the requirements of closing the facility in accordance with the Resource Conservation and Recovery Act (RCRA). A site workplan was developed that included removal of all tanks and associated piping that were considered part of the process regulated under RCRA. Concrete contaminated with RCRA-listed constituents in addition to concrete covering associated piping and tanks was also slated for removal. This work plan also included demolition of the old electroplating facility to prepare for new construction and reuse of the space. The removal of the contaminated concrete in the Old Plating Shop will expose soil that has been contaminated with waste listed under RCRA as part of the electroplating process. As long as the soil is exposed, there is an opportunity to reduce a potential source of groundwater degradation by removing some of the soil. The removal of this soil will be referred to herein as a reduction action for the purpose of reducing the effects of a potential source of groundwater degradation.

The Navy is following a time-critical path for reduction of a potential source of contamination as defined under the Superfund Accelerated Cleanup Model of the CERCLA process. This time-critical path is a way to achieve efficient remedial action by reduction of the CERCLA documentation process under circumstances similar to those occurring at the Old Plating Shop. The time-critical path is being used with regard to the time-critical nature of securing funding for the remediation of the site. A second limitation is the critical schedule of the construction of the new facility, which is intended as a follow-up project to site remediation. Additional costs to the Navy could be incurred if construction of the new facility is delayed. Furthermore, the existing permit for closure of the Old Plating Facility will expire on May 31, 1995, and an extension would be required if the completion of RCRA closure is delayed. The decision of following a time-critical documentation path under CERCLA has been agreed upon by the regulatory representatives of the NAS Jacksonville Partnering Team. This reduction action will be consistent with the overall CERCLA Remedial

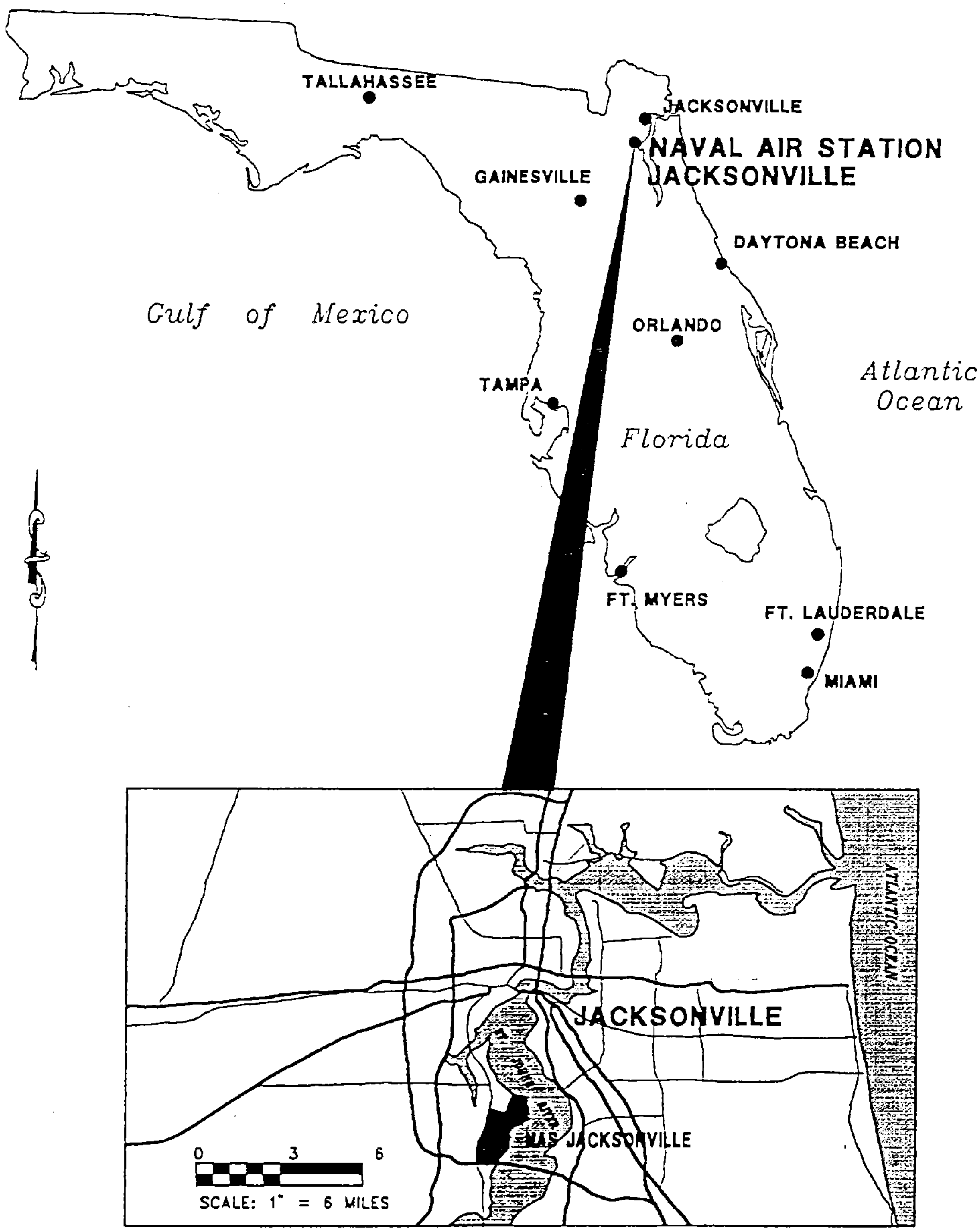

FIGURE 1-1
FACILITY LOCATION MAP

PRELIMINARY ECONOMIC EVALUATION REPORT FOR SOIL CONTAMINANT REDUCTION, BUILDING 101 NAS JACKSONVILLE JACKSONVILLE, FLORIDA

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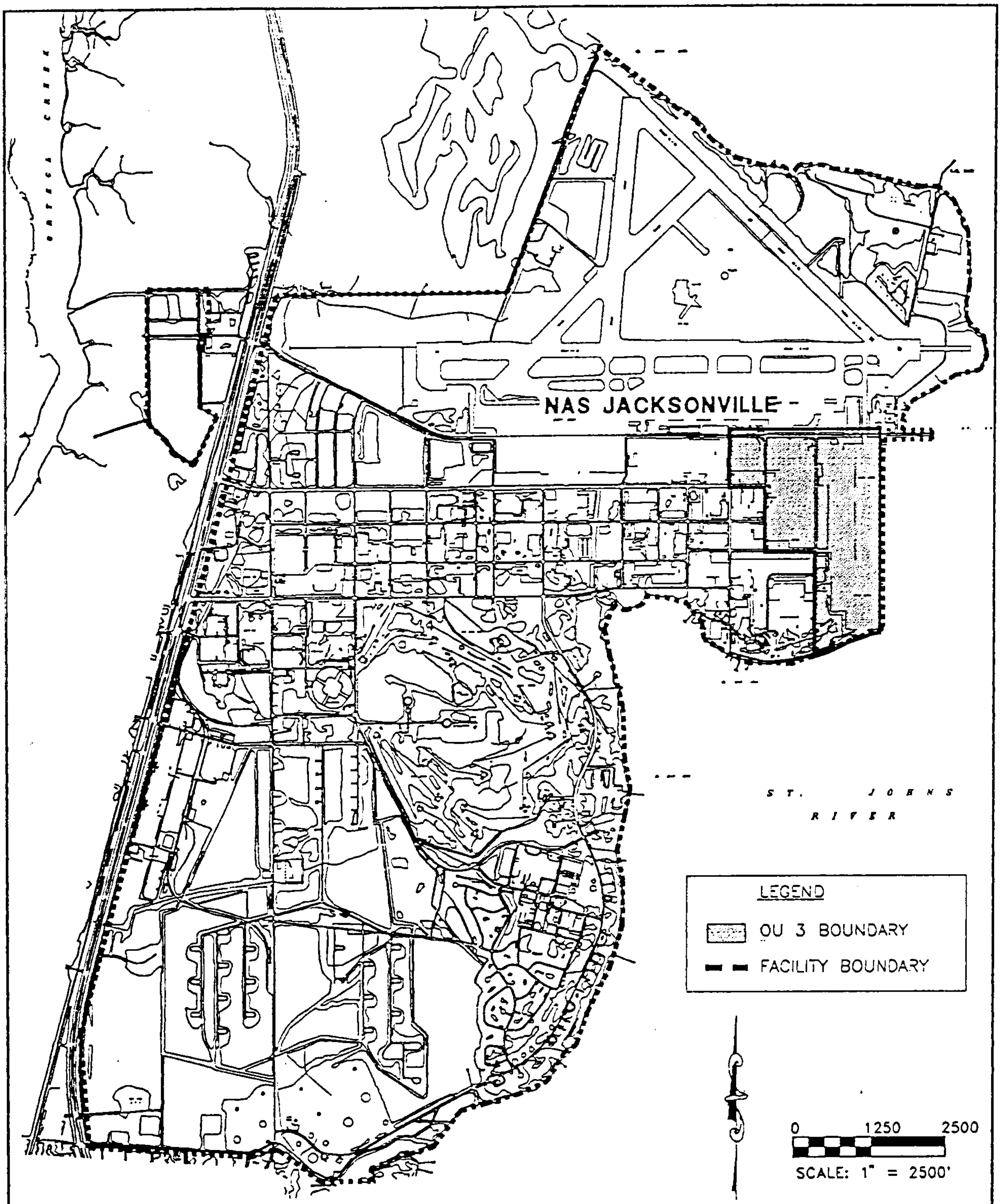

FIGURE 1-2
LOCATION OF OU 3

PRELIMINARY ECONOMIC EVALUATION REPORT FOR SOIL CONTAMINANT REDUCTION, BUILDING 101
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

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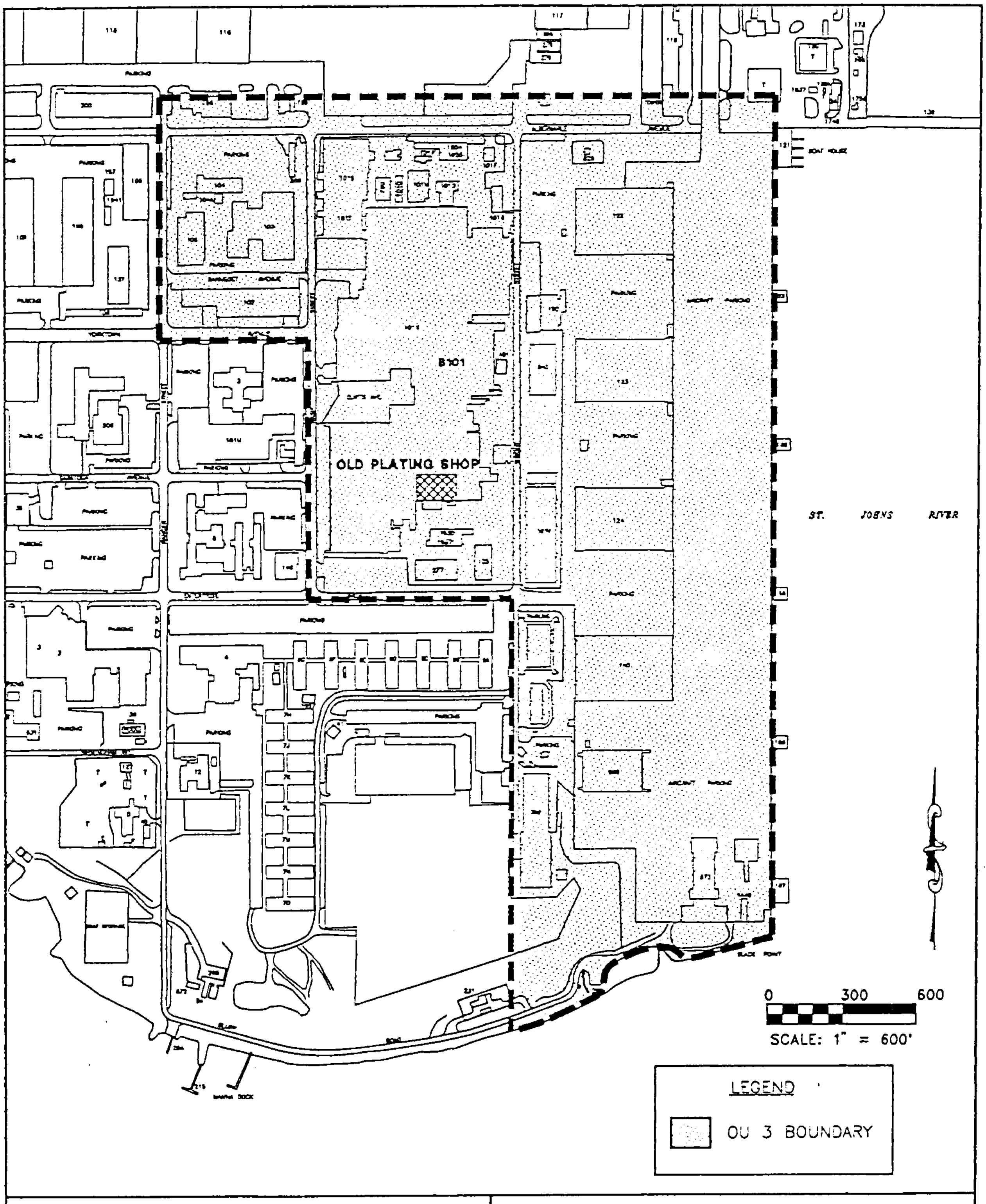

FIGURE 1-3
LOCATION OF OLD PLATING SHOP WITHIN OU 3

PRELIMINARY ECONOMIC EVALUATION REPORT FOR SOIL CONTAMINANT REDUCTION, BUILDING 101
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

OU3/OU3/DRM/12-22-94

Investigation and Feasibility Study (RI/FS) of OU 3 as discussed in the following paragraphs.

Because the object of this time-critical action is to reduce a potential source of groundwater contamination beneath the plating facility, this PEER has been generated to document the decision process followed during the evaluation of reduction alternatives. This PEER will be submitted to Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) for approval as part of the documentation process for contaminant source control beneath the Old Plating Shop. The PEER is not a document required under CERCLA for a time-critical process and is not subject to regulatory review. However, this submittal will be produced in Draft Final form for review by the NAS Jacksonville Partnering Team.

The reduction action recommended by the PEER is not intended to be the final action at the site. This area will be further evaluated during the overall CERCLA RI/FS process for OU 3, which is scheduled to be completed in 1997. The PEER document will be incorporated into a final Action Memorandum (AM), following completion of the reduction activities at the Old Plating Shop, Building 101. The AM will become part the Administrative Record for the Old Plating Shop and OU 3. The PEER includes the following information:

- a risk evaluation, including the methods, findings, location, and estimated volume of soil contributing to the potential degradation of groundwater quality;

- reduction action objective;

- identification and screening of remedial alternatives; and

- description and evaluation of the selected reduction action alternative including preliminary costing.

<u>**1.2 SITE HISTORY**</u>. The building housing the Old Plating Shop was built in the 1940's, with the actual plating operations commencing in the early 1960's. In 1985, construction of the new plating facility was completed, and operations in the Old Plating Shop were reduced. However, partial use of the Old Plating Shop was continued from 1985 to February 1990. In February 1990, use of the Old Plating Shop was discontinued, with the Navy filing an application for a closure permit for the facility. The closure permit was granted on May 31, 1994. ABB Environmental Services, Inc. (ABB-ES), performed a Health and Environmental Assessment at the facility in 1992. Prior to ongoing RCRA remedial and demolition activities, no other investigation was performed within the Old Plating Facility.

During the RCRA remedial and demolition activities, soil samples were taken at the Old Plating Shop by the Remedial Action Contractor (RAC), Ebasco Environmental, in January 1994. These samples were analyzed by an offsite laboratory for target analyte list (TAL) inorganics and target compound list (TCL) organics, using the Contract Laboratory Program (CLP) procedures. The results of these samples indicated the presence of elevated inorganic constituents beneath the concrete slab within the Old Plating shop (with respect to levels protective to groundwater quality) (Appendix A).

2.0 RISK EVALUATION

As a prologue to this submittal, ABB-ES provided a letter report to the Navy, presenting soil cleanup levels for the metal constituents that represent varying degrees of groundwater protectiveness as associated with excess cancer risk values. The letter report described the methodology used and recommended a soil remedial level for the constituents of concern. Recommendations were made with the assumption that residual risk would be quantitatively evaluated during the OU 3 RI/FS. Additionally, recommendations presented in this letter report were subsequently agreed to by the NAS Jacksonville Partnering Team during the November 30, 1994, partnering meeting and was followed by confirmation from SOUTHNAVFACENGCOM. A copy of this letter report for the source reduction remediation goals for the PEER can be found in Appendix B. The specifics for the source reduction remediation goals evaluation have been incorporated into the following sections.

2.1 METHOD OF RISK EVALUATION. Maximum concentrations for analytes detected from samples collected (TAL and TCL) at the Old Plating Shop during the RAC's site remediation process were compared with the proposed USEPA soil screening levels (SSLs) protective of groundwater. If the concentration detected onsite exceeded the SSL or if there was no analyte-specific SSL available, calculation of a site-specific soil cleanup level protective of groundwater was evaluated.

Table 2-1 summarizes the maximum concentration of analytes found onsite and the proposed USEPA screening levels. Based on comparison to the SSLs, potential contamination of groundwater from compounds in soil was considered for all constituents identified with a "Yes" in the "Retained" column. Analytes detected for which there were no SSLs were also retained for further evaluation.

The USEPA equation presented in Table 2-2 was used to calculate soil cleanup levels, which have been found to be protective of human health associated with ingestion of groundwater. The equation has been adjusted to relate a sorbed concentration in soil to the analytically measured total soil concentration. The cleanup levels for inorganics were derived using the equation in Table 2-2; however, inorganic-specific K_d values, modeled over a range of soil pH values (4.9, 6.8, and 8.0) identified by the USEPA, were used in the equation in place of the K_{oc} x f_{oc} parameters. In lieu of site-specific values, nonanalyte-specific parameters used in the equation are USEPA default values.

The target soil leachate concentrations for inorganics and organics are based on acceptable health-based concentrations associated with a cancer risk of $1x10^{-6}$, $1x10^{-5}$, or $1x10^{-4}$, or a noncancer hazard quotient of 0.1, 1.0, or 10, assuming ingestion of groundwater by an adult as described in Risk Assessment Guidances (RAGs). The one exception to this is the target soil leachate concentration for copper, which is based on the maximum contaminant level goal (MCLG) because there is inadequate information for the calculation of a reference dose. Additionally, the lead target soil concentration is based on an Office of Solid Waste and Emergency Response (OSWER) directive for soil cleanups of lead at superfund sites. Based on the average (arithmetic mean) site-specific pH of 7.8, the K_d values for a pH of 8.0 were used to calculate soil cleanup levels for inorganics. Chemical specific K_{oc}s and Henry's Law Constants for organics are from the literature.

Table 2-1
Comparison of Maximum Concentration Detected Onsite to Soil Screening Levels Considered Protective of Groundwater

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Analytes	Maximum Concentration	USEPA SSL DAF = 10	Retained?
Metals (mg/kg)			
Aluminum	9,550		Yes
Arsenic	3.7	15	No
Cadmium	334	6	Yes
Calcium	31,400		No[1]
Chromium	2,940	19	Yes
Cobalt	104		Yes
Copper	311		Yes
Iron	16,000		No[1]
Lead	442		Yes
Magnesium	2,330		No[1]
Manganese	113		Yes
Mercury	0.91	3	No
Nickel	90	21	Yes
Selenium	2.7	3	No
Silver	118		Yes
Thallium	5.5	0.4	Yes
Vanadium	18.1		Yes
Zinc	297	42,000	No
Cyanide (mg/kg)	10.2		Yes
Organics (mg/kg)			
Acetone	0.2	8	No
2-Butanone	0.018		Yes
Chlorobenzene	0.026	0.6	No
Chloromethane	0.053		Yes
1,2-Dichloroethene	0.017	0.2	No
Ethylbenzene	0.095	5	No
4-Methyl-2-pentanone	0.053		Yes
Toluene	0.052	5	No
Trichloroethene	0.11	0.02	Yes
Xylene (total)	0.37	74	No

See notes at end of table.

Table 2-1 (Continued)
Comparison of Maximum Concentration Detected On-site to Soil Screening Levels Considered Protective of Groundwater

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for Soil Contaminant Reduction
Old Plating Shop, Building 101
NAS Jacksonville, Jacksonville, Florida

Analytes	Maximum Concentration	USEPA SSL DAF = 10	Retained?
Acenaphthene	0.27	200	No
Anthracene	0.31	4,300	No
Benzo(a)anthracene	1.8	0.7	Yes
Benzo(a)pyrene	1.7	4	No
Benzo(b)fluoranthene	2.9	4	No
Benzo(g,h,i)perylene	1.1		Yes
bis(2-Ethylhexyl)phthalate	7	11	No
Butylbenzylphthalate	1.4	68	No
Carbazole	0.49	0.5	No
Chrysene	2.8	1	Yes
Di-n-octyl phthalate	1.4	14,000,000	No
Dibenzofuran	0.12		Yes
1,2-Dichlorobenzene	1.3	6	No
Fluoranthene	4.2	980	No
Fluorene	0.16	160	No
Indeno(1,2,3-cd)pyrene	1.2	35	No
Phenanthrene	2.6		Yes
Pyrene	2.9	1,400	No

[1] These compounds are considered essential nutrients and are not considered for soil cleanup.

Notes: USEPA = U.S. Environmental Protection Agency.
SSL = soil screening level.
DAF = dilution and attenuation factor.
mg/kg = milligrams per kilogram.

Table 2-2
Soil Cleanup Level Partitioning Equation for Migration to Groundwater

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$$\text{Soil Clean-up Level (mg/kg)} = C_w \left[K_D + \frac{(\theta_w + \theta_a H')}{\rho_b}\right]$$

Parameter	Definition	Default	Reference or Equation
C_w	Target soil leachate concentration	Chemical specific (mg/ℓ)	Calculated
K_d	Soil-water partition coefficient	Chemical specific (ℓ/kg)	K_{oc} x f_{oc} for organics Inorganic-specific K_d
K_{oc}	Soil organic carbon and water partition coefficient	Chemical specific (ℓ/kg)	
f_{oc}	Fraction organic carbon in soil	0.2% (0.002 g/g)	USEPA
θ_w	Water-filled soil porosity	0.3	w x ρ_b
w	Average soil moisture content	20% (0.2 kg_{water} /kg_{soil})	USEPA
ρ_b	Dry soil bulk density	1.5 (kg/ℓ)	(1-n) x ρ_s
n	Soil porosity	0.43 (L_{pore} /L_{soil})	USEPA
ρ_s	Soil particle density	2.65 (kg/ℓ)	USEPA
θ_a	Air-filled soil porosity	0.13 (L_{air}/ L_{soil})	n - θ_w
H	Henry's Law Constant	Chemical specific (atm-m^3/mol)	
H'	Henry's Law Constant	Unitless	H x 41, where 41 is a units conversion factor

Notes: mg/ℓ = milligrams per liter.
ℓ/kg = liters per kilogram.
g/g = grams per gram.
kg/ℓ = kilograms per liter.
atm-m^3/mol = atmosphere per cubic meters per molecule.

2.2 FINDINGS OF RISK EVALUATION. Presented in Tables 2-3 and 2-4 are potential interim soil remediation levels, considered to be protective of groundwater. These cleanup levels are calculated based on concentrations associated with acceptable cancer risks of $1x10^{-6}$, $1x10^{-5}$, or $1x10^{-4}$, or noncancer hazard quotients of 0.1, 1.0, or 10. These levels of risk were chosen because they are indicative of an acceptable level of exposure as defined in the National Contingency Plan. In addition, a cancer risk of $1x10^{-6}$ or less is considered by EPA to be *de minimis*. The range of noncancer hazard quotients chosen are centered around 1.0, a value generally considered to be without deleterious effects, even for sensitive individuals. The interim cleanup levels presented for the Old Plating Shop contaminated soil are considered to be adequate to reduce the potential impact to groundwater from soil. However, further consideration of potential risks and hazards for this location will be addressed in the OU 3 RI/FS.

Copper, lead, 2-butanone, chloromethane, and 4-methyl-2-pentanone had interim soil remediation levels protective of groundwater calculated because there were no analyte-specific SSLs available for comparison. Additionally, no cleanup levels were calculated for constituents where there was a lack of information provided by the RAC to allow for their quantification.

The values presented in Tables 2-3 and 2-4 are based upon the assumption that there has been no attenuation or dilution of the contaminant (i.e., the concentration at the receptor point is equal to the concentration in soil leachate as it leaves the source). However, for modeling purposes, a USEPA dilution/attenuation factor (DAF) can be applied to factor dilution/attenuation of contaminants as they migrate through the unsaturated zone.

Maximum concentrations of chromium, cadmium, and thallium were evaluated with regard to soil volumes that would require removal, depending on the level of protectiveness selected. Interim remediation, based upon these maximum concentrations, would also encompass all other contaminants that would require removal under the different protectiveness scenarios.

Figure 2-1 illustrates the proposed area of concrete to be removed and the concentrations of chromium, cadmium, and thallium which represent maximum concentrations for these metals at depths ranging from 0 to 18 inches to 3 to 24 inches below land surface. When these concentrations are evaluated, with respect to the varying proposed interim soil remediation levels for the three hazard indices of 0.1, 1.0, and 10 (representing risk equal to 10^{-6} to 10^{-4}), the areal extent of soil removal changes significantly.

Figure 2-2 illustrates the areal extent of soils that would require removal under the three protectiveness scenarios. As indicated by Figure 2-2, removing soil to the 0.1 and 1.0 hazard index would require excavation outside the proposed area for contaminated concrete removal to the boundary of the soil samples collected. Interim soil remediation to the 10 hazard index approximates the proposed concrete removal area and would be supportive of the objective to reduce source contamination for protectiveness of groundwater quality, with quantitative evaluation of residual risks being conducted at a later date during the RI/FS for OU 3.

Table 2-3
Site-Specific Cleanup Levels Protective of Groundwater Based on an Acceptable Range of Cancer Risks

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Compound	Maximum Concentration	$1x10^{-6}$	$1x10^{-5}$	$1x10^{-4}$
Volatile Organic Compounds (mg/kg)				
Trichloroethene	0.11	0.00374	0.0374	0.374
Semivolatile Organic Compounds (mg/kg)				
Benzo(a)anthracene	1.8	0.322	3.22	32.2
Chrysene	2.8	0.467	4.67	46.7

Note: mg/kg = milligrams per kilogram.

Table 2-4
Site-Specific Clean-up Remediation Levels Protective of Groundwater Based on a Range of Noncancer Hazard Quotients

Preliminary Economic Evaluation Report
for Soil Contaminant Reduction
Old Plating Shop, Building 101
NAS Jacksonville, Jacksonville, Florida

Compound	Maximum Concentration	0.1	1	10
Metals (mg/kg)[1]				
Cadmium	334	8.21	82.1	821
Chromium (hexavalent)	2,940	0.259	2.59	25.9
Copper	311		[2]37,100	
Lead	442	[3]400	[3]400	[3]400
Nickel	90	10.5	105	1,050
Thallium	5.5	0.0281	0.281	2.81
Volatile Organic Compounds (mg/kg)				
2-Butanone	0.018	0.458	4.58	45.8
Chloromethane	0.053	0.00617	0.0617	0.617
4-Methyl-2-Pentanone	0.053	0.0696	0.696	6.96

1 K_d values were available for the following metals: arsenic, barium, beryllium, cadmium, chromium (hexavalent), copper, mercury, nickel, selenium, thallium, and zinc (U.S. Environmental Protection Agency [USEPA]).

2 For copper, a soil clean up level was proposed using the maximum contaminant limit goal (MCLG) of 1.3 milligrams per liter (mg/ℓ).

3 USEPA Office of Solid Waste and Emergency Response (OSWER) Directive No. 9355.4-12, dated July 14, 1994, interim recommended soil cleanup level at Superfund sites for residential settings.

Note: mg/kg = milligrams per kilogram.

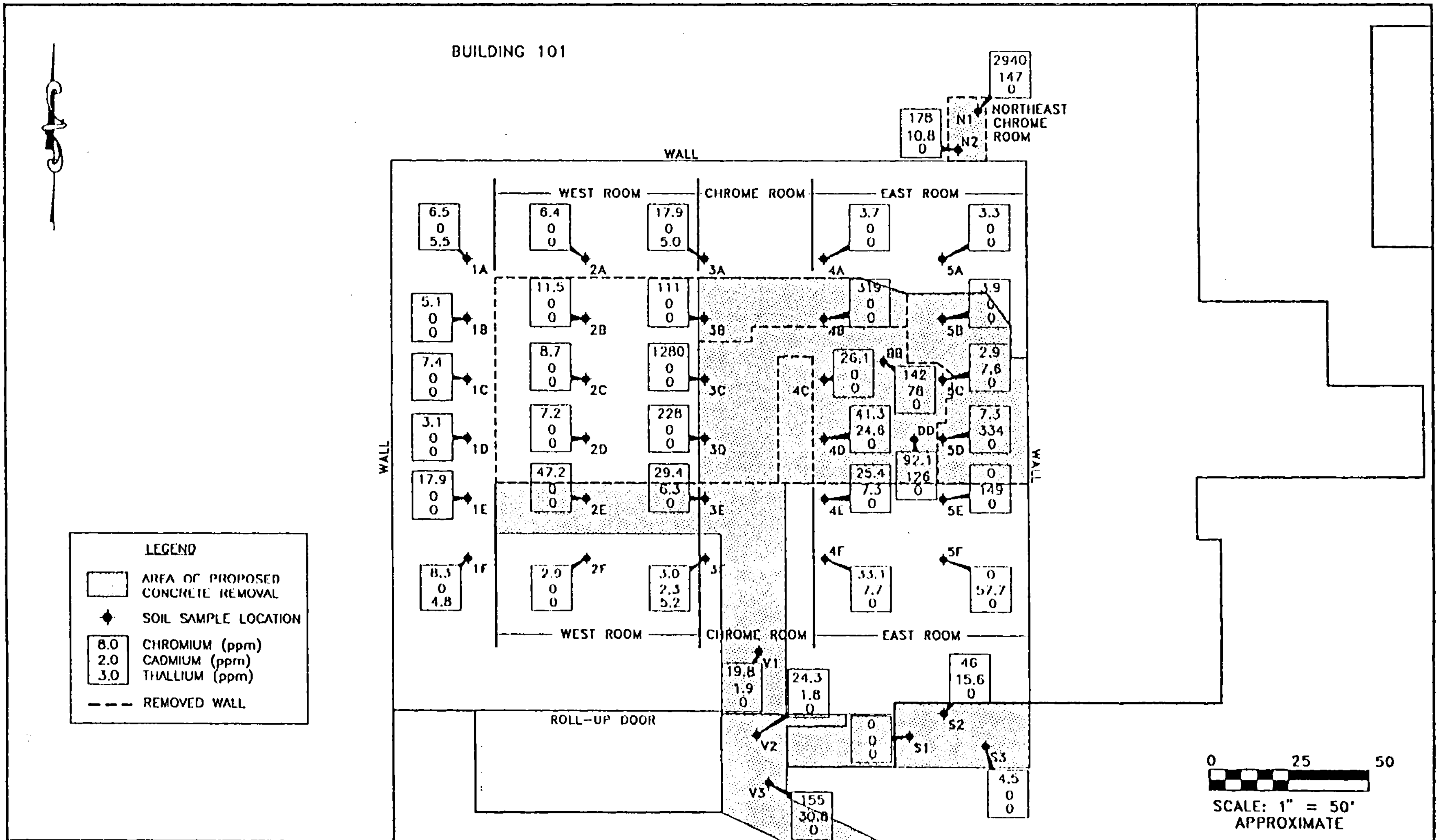

FIGURE 2-1

CONTAMINANT CONCENTRATIONS AND PROPOSED AREA OF CONCRETE TO BE REMOVED, OLD PLATING SHOP

PRELIMINARY ECONOMIC EVALUATION REPORT FOR SOIL CONTAMINANT REDUCTION, BUILDING 101 NAS JACKSONVILLE JACKSONVILLE, FLORIDA

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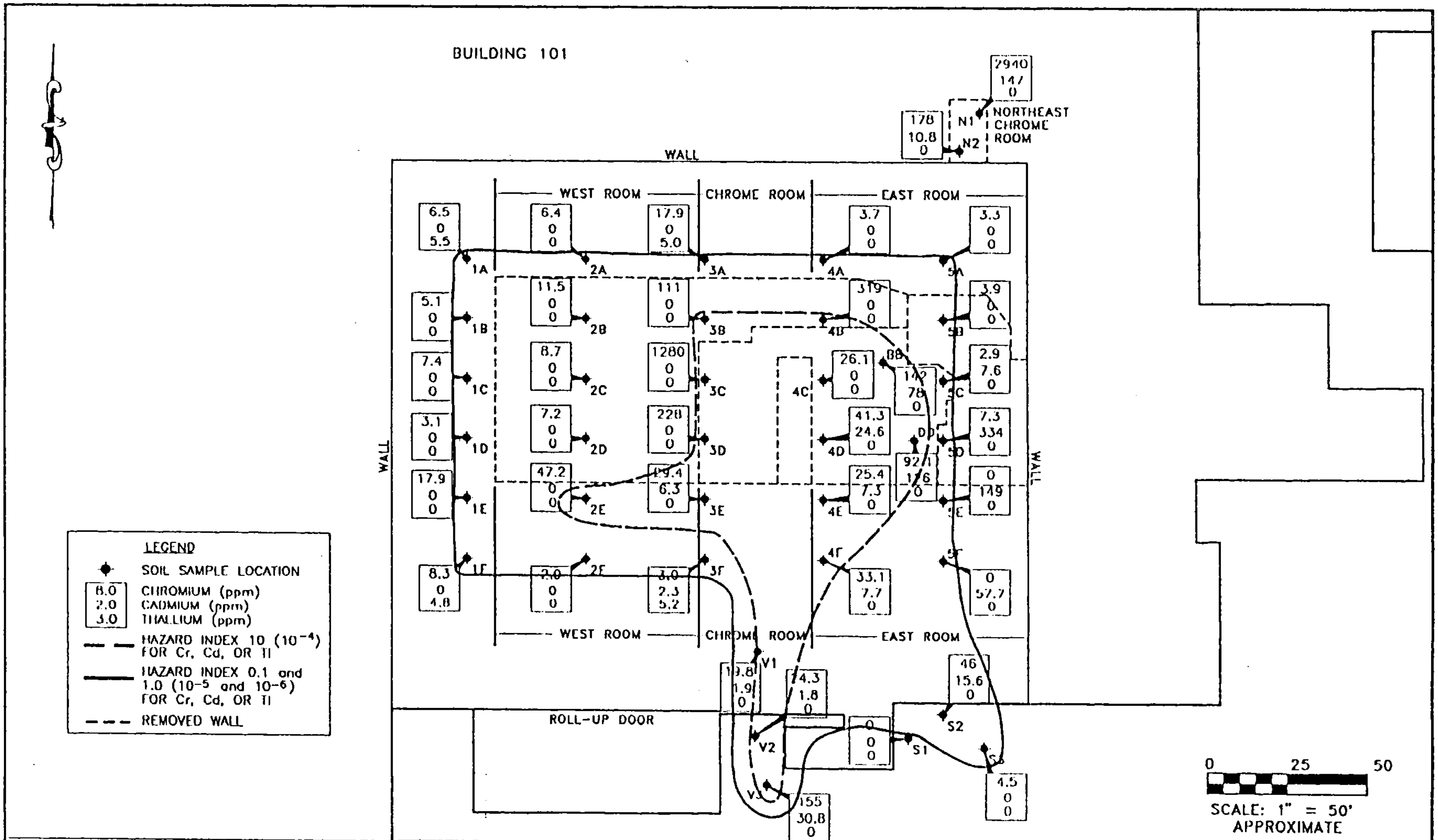


FIGURE 2-2
AREAL EXTENT OF SOIL REMOVED UNDER VARYING RISK SCENARIOS, OLD PLATING SHOP

PRELIMINARY ECONOMIC EVALUATION REPORT FOR SOIL CONTAMINANT REDUCTION, BUILDING 101 NAS JACKSONVILLE JACKSONVILLE, FLORIDA

/DWGS/OU3/B101/DRM/12-22-94

2.3 UNCERTAINTIES AND ASSUMPTIONS. The conceptual model employed by the USEPA to develop the guidance used in this PEER is protective for a source area of up to 30 acres. The model also assumes an infinite source that extends to the water table. Attenuation in the unsaturated zone is also not considered; thus, a conservative estimation is developed. Dilution can be assumed within the aquifer to the point of compliance at the edge of the site by applying a default DAF of 10. Because the source being considered here is much smaller than the 30 acres assumed by the USEPA, the default DAF of 10 could also be an underestimation of dilution/attenuation.

2.4 RECOMMENDATION FOR SOURCE REDUCTION REMEDIATION GOALS. Because the intent of the source reduction remediation is to capitalize on an existing construction project and to be supportive of the OU-3 FS and future remediation goals, removal of contaminated soils from beneath the Old Plating Shop concrete slab that will result in residual soil concentrations protective to groundwater to a 10^{-4} and/or 10 hazard coefficient is recommended. Soils to be removed would be within the "foot print" of the contaminated concrete planned for removal as part of the Old Plating Shop demolition (Figure 2-2). This scenario is also consistent with the logistical and schedule concerns of the Old Plating Shop demolition project. Residual risks resulting from contaminated soils not removed will be evaluated quantitatively during the OU 3 RI/FS.

3.0 SOURCE REDUCTION OBJECTIVES

The source reduction action objectives for the Old Plating Shop are consistent with the remedial action objectives of the overall RI/FS at OU 3. Based on information previously presented in this report, the interim reduction action objective for the Old Plating Shop is to reduce the volume of contaminated soil directly beneath the previously identified contaminated concrete removal area, thereby reducing the potential degradation of groundwater quality. Attainment of this objective will be made possible by the RAC's removal of contaminated concrete at the Old Plating Shop. The objective or intent is not to remove all the contaminated soil or all of the source that may contribute to groundwater degradation. The intent of this action is to reduce, where economically and logistically feasible, the source of potential groundwater contamination during the opportunity provided by demolition activities. As mentioned previously, risks caused by residual contaminated soils not removed during the source reduction remediation would be quantitatively evaluated during the OU 3 RI/FS.

4.0 IDENTIFICATION AND SCREENING OF REMEDIAL ALTERNATIVES

Source control technologies for the Old Plating Shop were identified based upon review of current literature, vendor information, operational restrictions surrounding the Old Plating Shop, and experience in developing remedial alternatives for similar sites with similar contaminants. Technology screening also factored on-site and waste-specific characteristics.

During the identification and screening process, technologies were evaluated with regard to effectiveness and implementability. Technologies that were identified and evaluated were *in situ* and *ex situ* stabilization with redeposition onsite and excavation with offsite stabilization and disposal. The screening process provided information that raised facility and RAC concerns that there would be major logistical problems with *in situ* and *ex situ* stabilization with redeposition onsite (due to the fact that there is no area available for staging) and that material redeposited must be suitable for structural building loads (i.e., must be compactable to handle loads from a building structure). Additionally, the facility was concerned that the stabilization process would cause schedule delays that would lead to contract delays and change orders.

As a result of the above concerns and logistical restraints, the alternative identification and screening selected excavation with offsite stabilization and disposal as the only technology that would be technically effective and could be implemented within the time constraints imposed.

5.0 DESCRIPTION AND EVALUATION OF THE SELECTED SOURCE REDUCTION ALTERNATIVE

The purpose of this section is to identify and discuss the selected alternative for reduction of inorganic contaminants in the soil beneath the Old Plating Shop. As discussed in Chapter 4.0, the logistic and feasibility issues associated with the Old Plating Shop site necessitated a very focused screening of alternatives.

5.1 DESCRIPTION OF THE SELECTED ALTERNATIVE. The selected alternative for this reduction action is excavation of contaminated soil, offsite treatment by stabilization, and disposal of the stabilized soil in an offsite permitted disposal facility. This alternative proposes using stabilization, a proven technology and the most efficient remedy for the contaminants and conditions encountered at the Old Plating Shop. Stabilization is a process by which the contaminated soil is mixed with a setting agent (e.g., cement, fly ash, and lime) to create a product in which the soil contaminants become entrapped or encapsulated, thus allowing for land disposal.

5.2 EVALUATION OF THE SELECTED ALTERNATIVE. This alternative meets the reduction action objective. For the purpose of this report, the selected alternative was evaluated using the following criteria:

(1) feasibility of construction after completion of the reduction action;
(2) economic feasibility of the reduction action;
(3) ease of implementation of the reduction action considering site constraints;
(4) reduction in mobility, toxicity, or volume;
(5) short-term effectiveness; and
(6) long-term effectiveness and performance.

5.2.1 Feasibility of Construction After Completion of Reduction Action The Navy plans to reuse the space made available by the demolition of the Old Plating Shop by constructing a new facility shortly after completion of the soil reduction action. This new facility would need appropriate foundational support. Stabilized material generally does not provide the appropriate support characteristics. Additionally, stabilization works best as a remedial technology if the soil is undisturbed after treatment. If the soil is disturbed after treatment, the surface area is exposed, leading to increased leaching potential. Therefore, based on this criterion, the selected alternative would be feasible for the construction of the new facility because it proposes removing the soil to an offsite facility, allowing the excavation to be filled with appropriate back fill material for foundation support.

5.2.2 Economic Feasibility of Implementation The second criterion is related to the volume of soil to be treated. It has been estimated that approximately 700 cubic yards (yd^3) of contaminated soil would be removed as part of the selected alternative (see Appendix C for volume estimate calculations). As determined from conversations with various stabilization suppliers, there is an economic limit to be considered when comparing offsite treatment and disposal and other remedies. For the 700-yd^3 volume of soil to be removed, offsite stabilization and disposal is a more cost effective alternative than mobilization costs for onsite stabilization. Since the selected alternative proposes offsite treatment and disposal, it is economically feasible for the amount of soil that will be removed at the Old Plating Shop (see Appendix D for preliminary costing information for the selected alternative).

<u>5.2.3 Ease of Implementation Given Site Constraints</u> The third criterion, site constraints, was also a major factor in selecting the appropriate alternative. After consulting with the RAC, the following logistical concerns for activities associated with onsite treatment were determined:

- excessive mobilization and demobilization and installation costs for equipment to handle and batch the materials during onsite treatment activity, based upon the small volume of soil identified for remediation;

- additional cost of fuel, maintenance, and operation of equipment to treat, handle, and batch materials during onsite treatment activity;

- adequate area for stockpiles of contaminated materials, stockpiles of curing material, and storage of batch equipment not available for onsite treatment activity; and

- impact to the facility closure deadline and new construction start date caused by additional activities associated with onsite treatment activities.

The selected alternative would require less equipment to excavate and handle materials than an onsite treatment activity. Additionally, the selected alternative does not require space for stockpiles of curing material or area for the stabilization process that are required for onsite stabilization. From discussion with the facility and the RAC, these area requirements for onsite stabilization are not available.

<u>5.2.4 Reduction in Mobility, Toxicity, or Volume</u> Treated soil would be disposed at an RCRA subtitle C landfill. Landfills are designed to control leaching and runoff of contaminants. Therefore, disposal of the fixated soil in a landfill would further reduce the mobility of soil, which already has been immobilized after the stabilization process. Additionally, the selected alternative would reduce the potential mobility of residual source contaminants for groundwater protection due to the overall reduction of the source contaminants.

<u>5.2.5 Short-term Effectiveness</u> Offsite disposal of the stabilized material minimizes the potential for residual groundwater degradation and future exposure to residual contaminated soil. Therefore, this alternative significantly reduces the contaminant source.

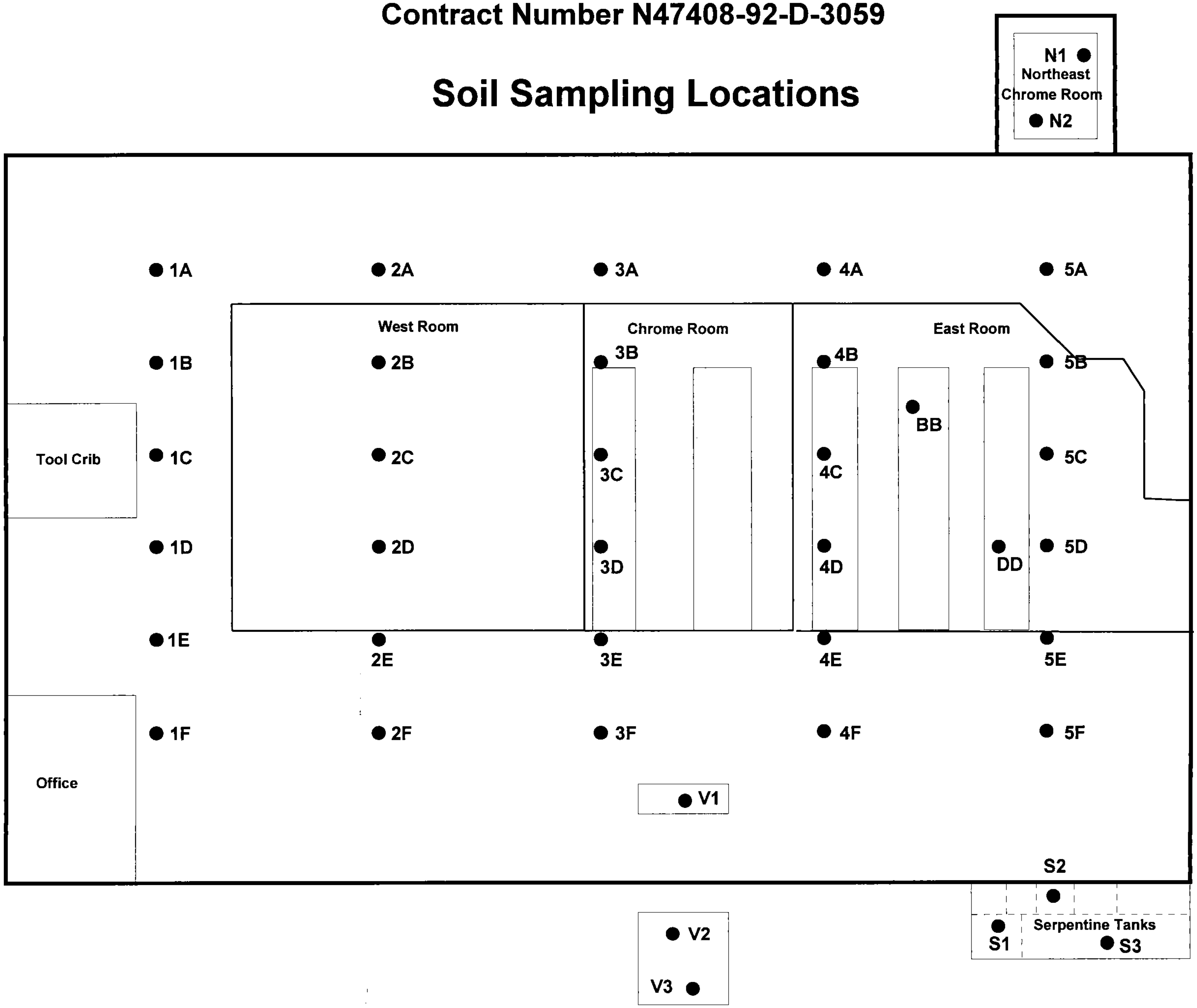
<u>5.2.6 Long-term Effectiveness and Performance</u> Contaminated soil at the site will be permanently removed, thus eliminating it as a source of degradation to groundwater quality. Therefore, this alternative provides a permanent solution to the contaminated soil removed from the Old Plating Shop.

APPENDIX A

PREVIOUS SOIL SAMPLE LOCATION AND RESULTS

NAS-JAX Plating Shop
Ebasco Environmental
Contract Number N47408-92-D-3059

Soil Sampling Locations



January 11, 1994

	1A-1	1A-2	1A-3	2A-1	2A-2	2A-3	3A-1	3A-2	3A-3	4A-1	4A-2	4A-3	5A-1	5A-2	5A-3	1B-1	1B-2	1B-3
Metals (mg/kg)																		
Aluminum	3,520	497	123	1,860/2,830	346	119	3,120	2,210	780	470	407	58.2	1,440	334	955/893	1,220	2,090	126
Calcium	1,360			1,160/1,180			3,070		1,740						1,770/1,940	1,330	2,380	
Chromium	6.5			4.8/6.4			6.5	3.6	17.9		3.7		3.3			3.0	5.1	
Iron	4,050	482	144	2,520/3,320	504	241	2,230	811	575	547	417	178	1,530	443	1,680/2,010	1,950	3,160	158
Lead	6.5	0.76	1.5	4.0/4.4	0.74	1.4	4.8	2.0	2.3	2.3	2.1		5.4	1.0	7.4/7.6	4.1	4.2	1.6
Manganese	19.1		6.8	14.6/18.1	3.2	8.1	23.3	14.3	4.0		5.5		9.6	3.5	20.0/22.7	11.9	14.2	11.1
Mercury			0.13												0.30/0.04			
Selenium		2.7					2.4											
Thallium		5.5					5.0											
Zinc	6.7			4.9/5.6			6.1								8.0/6.9	9.3	10.5	8.0
pH	7.65	4.40	6.90	8.45/8.35	5.35	7.30	8.80	8.05	7.80	8.50	8.20	7.30	9.10	8.10	6.00/6.30	8.45	3.65	6.60
Cyanide (mg/kg)																		
Volatile Organic Compounds (mg/kg)																		
Acetone	0.140			0.024/0.053									0.061	0.016	0.056/0.020(0.041/0.047)	0.065		
4-Methyl-2-Pentanone														0.015				
Toluene															ND/ND (ND/0.015)			
Semivolatile Organic Compounds (mg/kg)																		
Butylbenzylphthalate	0.700																	
Fluoranthene													0.830					
Pyrene													0.640					
Chrysene													0.440					
Benzo (b) fluoranthene													0.500					

	2B-1	2B-2	2B-3	3B-1	3B-2	3B-3	4B-1	4B-2	4B-3	bl-1	bl-2	5B-3	1C-1	1C-2	1C-3	2C-1	2C-2	2C-3
Metals (mg/kg)																		
Aluminum	3,850		94.6	592	234	104/178	4,750	182	169	511	181	1,970	3,500	222	149	1,120/639	279	65.4
Calcium	1,570									2,350			1,920					
Chromium	7.7		11.5		8.4	96.2/111	75.9	4.2	319			3.9	7.4			2.9/ND		8.7
Copper										7.8								
Iron	4,260	576	110	833	407	129/249	13,500	340	202	995	283	1,980	6,940	396	156	1,590/962	458	106
Lead	5.0	1.0	1.3	5.0	10.1	1.1/1.2	3.1	2.1	1.8	4.3		2.7	5.3	0.8	1.3	2.0/1.6	8.2	1.7
Manganese	28.1		8.7	7.3		10.4/12.2	5.3		6.1	7.5		11.5	17.6		7.5	9.6/7.4		11.4
Mercury										0.44								
Vanadium							18.1						11.5					
Zinc	9.4				4.6			6.3	5.9			9.3	9.6			ND/4.7		
pH	8.30	4.90	5.95	8.20	7.50	6.60/6.95	7.40	7.35	6.30	8.85	7.55	5.90	8.20	5.45	6.60	9.15/8.90	6.05	5.55
Cyanide (mg/kg)																		
Volatile Organic Compounds (mg/kg)																		
Acetone				0.058								0.017				ND/0.018		
Chloromethane				0.053			0.018											
Semivolatile Organic Compounds (mg/kg)																		
Benzo (b) fluoranthene																0.410/ND		

	3C-1	3C-2	3C-3	4C-1	4C-2	5C-1	5C-2	1D-1	1D-2	1D-3	2D-1	2D-2	2D-3	3D-1	3D-2	3D-3	4D-1	4D-2
Metals (mg/kg)																		
Aluminum	654	1,620	6,980	1,040	1,830	479	1,750/2,020	1,090	251	58.7	3,450	264	124	145	82.9	718/783	596	723
Arsenic											2.5							
Cadmium						1.5	6.8/7.6										6.1	24.6
Calcium	2,570			1,750		6,980					2,830			5,070				
Chromium	742	1,280	246	26.1	3.1	2.9		3.1			7.2		7.1	228	92.5	6.0/4.9	69.4	413
Cobalt				40.3										104				
Copper				65.1										15.0			19.4	10.8
Iron	1,320	790	6,180	16,000	1,310	469	584/673	2,000	367	158	5,220	359	208	4,480	275	576/572	569	898
Lead	22.2	1.5	7.8	5.6	3.6	2.5	2.1/2.3	2.3	2.1	0.8	5.9	2.1	1.2	117	1.3	2.7/2.9	24.3	76.7
Manganese	7.4		5.4	70.8	5.5	6.6		7.2		10.9	26.9		6.4	24.8			5.2	8.6
Nickel				19.2													29.6	21.6
Silver				17.5										4.8			3.0	10.3
Vanadium			17.1															
Zinc				9.4		5.2					12.7	4.2		11.7			6.3	11.1
pH	9.70	7.40	6.65	8.80	6.90	12.30	7.20/6.85	8.80	4.85	5.35	8.50	5.55	6.75	11.10	7.70	7.35/7.30	11.30	9.70
Cyanide (mg/kg)			2.7				1.6/2.8							1.5				
Volatile Organic Compounds (mg/kg)																		
Acetone	0.042	0.038		0.029	0.063	0.200	0.040/0.029	0.027			0.016			0.110		0.024/0.068	0.033	0.035
4-Methyl-2-Pentanone						0.017												
Toluene				0.014														
Trichloroethene	0.110															ND/0.049		
Xylene (total)	0.059			0.034										0.028		ND/0.064		
1,2 Dichloroethene																	0.045	0.017
Semivolatile Organic Compounds (mg/kg)																		
Butylbenzylphthalate	1.400																	
Benzo (a) Pyrene				1.000 (1.700)	0.690 (0.930)													

	5D-1	5D-2	5D-3	1E-1	1E-2	1E-3	2E-1	2E-2	2E-3	3E-1	3E-2	3E-3	4E-1	4E-2	4E-3	5E-1	5E-2	5E-3
Metals (mg/kg)																		
Aluminum	1,820	167	356	2,450	9,550	865	1,040/383	161	731	2,730	1,520	1,510	343	185	96.2	449	112/183	456
Arsenic					3.5													
Cadmium	334	62.0	43.8							3.7	5.1	6.3		1.3	7.3		14.9/14.0	149
Calcium	16,800			3,560	3,930	1,380	1,410/1,130			60,500	24,500	26,700						
Chromium	7.3		2.5	5.0	17.9		10.5/47.2	4.7	5.1	10.2	29.4	19.9			25.4			
Copper	311	58.6	80.0								7.1						6.8/7.1	
Iron	2,430	318	2,150	2,340	11,200	1,010	3,180/737	501	1,420	1,410	1,460	1,440	608	398	99.6	683	312/356	452
Lead	8.3	1.4	1.5	4.0	7.6	6.6	3.5/1.9	9.0	4.8	61.9	75.4	83.0	1.4		2.3	1.5	0.52/0.65	1.8
Magnesium					1,940					2,330								
Manganese	16.1		17.9	15.9	99.2	7.5	17.0/5.2		6.9	91.8	37.9	36.0	3.7		4.2	5.5		15.3
Mercury			0.34							0.08		0.06						
Nickel	54.2	18.2	58.4			17.3			33.3									
Vanadium					17.8													
Zinc	33.0	14.8		8.7	22.9	10.0	25.7/11.0	5.0	5.4	71.0	40.3	66.0						
pH	8.50	8.30	7.55	8.20	6.50	4.30	8.50/8.85	7.80	5.20	8.40	8.40	8.40	8.40	8.60	8.30	8.90	8.90/8.85	7.40
Cyanide (mg/kg)	10.2	2.3	8.1															
Volatile Organic Compounds (mg/kg)																		
Acetone									0.017		0.023	0.014		0.020				
Toluene																		0.024
Semivolatile Organic Compounds (mg/kg)																		
bis (2-ethylhexyl) Phthalate																1.800		

	1F-1	1F-2	1F-3	2F-1	2F-2	2F-3	3F-1	3F-2	3F-3	4F-1	4F-2	4F-3	5F-1	5F-2	5F-3	BB-1	DD-1
Metals (mg/kg)																	
Aluminum	3,900	309	2,030	1,100	230	139	944	523	403/599	737	200	2,240	371	154	275	126	248
Cadmium							2.3					7.7			57.7	78.0	126
Calcium	3,970			2,570			7,890										
Chromium	8.3		4.9	2.9			3.0			2.7	3.2	33.1				142	92.1
Cobalt				20.8													
Copper				5.4												78.4	59.3
Iron	4,400	547	2,240	2,350	415	205	1,580	597	391/595	911	327	2,430	528	209	237	339	523
Lead	6.0	0.91	3.1	2.0		1.2	11.6	0.66	1.4/1.9	2.5	0.75	4.6	0.87		1.7	33.8	31.5
Manganese	25.8	4.1	8.7	28.3			15.8	11.9	3.4/9.5	8.2		15.1	4.0		4.1	6.1	8.9
Mercury	0.06															0.12	0.06
Selenium	2.6																
Silver				9.0	2.3											13.1	9.5
Thallium	4.8								0.18/5.2								
Zinc	10.1			6.1			7.3			4.2		7.5				276	131
pH	9.00	6.75	7.20	9.00	5.05	6.35	8.35	8.50	8.70/8.75	8.90	8.90	8.25	9.70	10.00	7.70	7.90	8.15
Cyanide (mg/kg)																1.8	10.0
Volatile Organic Compounds (mg/kg)																	
Acetone	0.040			0.025		0.019		0.031					0.012			0.057	0.033
Toluene																	0.012
Trichloroethene																	0.042 (0.026)
2-Butanone																	0.015
Semivolatile Organic Compounds (mg/kg)																	
bis (2-ethylhexyl) Phthalate																0.160	7.000

	V1-1	V2-1	V2-2	V3-1	V3-2	S1-1	S2-1	S3-1	N1-1	N1-2	N1-3	N2-1	N2-2
Metals (mg/kg)													
Aluminum	1,370	1,100	634	1,590	709	261	404	410	1,040	438/1,610	1,500	7,300	178
Arsenic												3.7	
Barium				50.0									
Cadmium	1.9		1.8	30.8	7.9		15.6		57.6	147/74.3		4.2	10.8
Calcium	1,810	8,880	16,900	11,900	31,400	4,810	5,410	11,900		854/1,410		12,000	
Chromium	19.8	6.0	24.3	155	77.1		46.0	4.5	585	2,940/1,200	1,340	28.0	178
Cobalt	32.0								28.6	12.7/21.6		20.4	
Copper		7.3		99.4	47.3		14.9		116	126/173			22.2
Iron	3,810	931	1,040	12,100	1,270	298	2,120	1,150	1,240	434/2,010	291	9,580	181
Lead	33.4	151	28.0	442	73.8	2.2	85.3	8.7	4.0	2.4/3.0	2.5	18.0	1.7
Magnesium												1,540	
Manganese	32.9	27.6	11.9	113	13.6	4.6	10.4	8.3	13.8	8.3/17.5	8.1	36.9	9.4
Mercury		0.61	0.91	0.58	0.19								0.05
Nickel			32.7	90.0	10.3					2.4/11.5			
Silver	2.8			7.1			25.7		65.4	5.9/117			118
Vanadium												15.8	
Zinc	10.4	55.6	19.0	297	42.2		13.7		15.1	80.4/18.2		20.1	
pH	7.65	8.30	8.45	8.20	8.50	9.60	10.80	10.80	8.25	6.95/7.05	6.70	8.40	6.65
Cyanide (mg/kg)							1.8				5.2		
Volatile Organic Compounds (mg/kg)													
Acetone	0.033					0.021		0.049	0.083	0.026/ND	0.022	0.047	
4-Methyl-2-Pentanone							0.053						
Toluene						0.034	0.052			ND/0.014			
Xylene (total)						0.014	0.370						
Ethylbenzene							0.095						
Chlorobenzene											0.026		
2-Butanone	0.018												

	V1-1	V2-1	V2-2	V3-1	V3-2	S1-1	S2-1	S3-1	N1-1	N1-2	N1-3	N2-1	N2-2
Semivolatile Organic Compounds (mg/kg)													
Fluoranthene			1.400	4.200	0.960							0.860	
Pyrene			2.200	2.900	1.300							0.900	
Chrysene			1.900	2.800	0.790							0.610	
Benzo (b) fluoranthene			2.900	2.800	1.200							0.840	
Benzo (a) pyrene	0.370		1.400	1.600	0.510							0.390	
bis (2-ethylhexyl) Phthalate				3.000									
Di-n-octyl Phthalate						1.400							
Benzo (a) Anthracene			1.500	1.800	0.600							0.540	
1,2-Dichlorobenzene										ND/1.300			
Dibenzofuran				0.120									
Fluorene				0.160									
Anthracene				0.310									
Carbazole				0.490									
Phenanthrene				2.600	0.800							0.570	
Acenaphthene				0.270									
Indeno (1 2 3-cd) pyrene			0.720	1.200	0.420								
Benzo (g h i) perylene			0.750	1.100	0.520								

APPENDIX B

SUPPORTING RISK EVALUATION DOCUMENTATION

ASEA BROWN BOVERI

November 11, 1994

Southern Division
Naval Facilities Engineering Command
ATTN: Mr. Dana Gaskins, Code 1857
2155 Eagle Drive, P.O. Box 190010
North Charleston, South Carolina 29419-9010

Subject: Source Reduction Remediation Goals for the Preliminary Economic Evaluation Report, Old Plating Shop, NAS JAX

Dear Dana:

Please find enclosed ABB's evaluation of soil reduction remediation goals for contaminated soils beneath the Old Plating Shop. The memo presents the methods used to calculate and evaluate soil clean up levels with regards to varying risk levels ranging from 10^{-4} to 10^{-6}. The intent of the memo is to evaluate source reduction with regards to supporting a more quantitative evaluation of residual risks during the RI/FS for OU-3 . A primary factor in the evaluation was comparing the proposed excavations required for each source reduction scenario against the concrete slab removal proposed for the Old Plating Shop demolition (i.e. evaluating the economics and logistics of excavating additional concrete and soil versus the risk reduction gained).

The memo presents areal extent of excavations to meet risk reductions of 10^{-4}, 10^{-5}, and 10^{-6}. The excavations range from approximately 3500 yrd^3 (for 10^{-6} and 10^{-5} risk levels) to 700 yrd^3 (for 10^{-4} risk level). These estimates assume the excavations would average a three foot depth. Additionally, if a cost of \$130/yrd^3 is assumed to be representative for transportation and disposal of the excavated material to a hazardous waste landfill, the excavations represent cost from \$455,000 to \$91,000 (\$130/yrd3 was the average cost used for the focused FS at OU-2).

Considering the intent of the source reduction action for the Old Plating Shop, it is recommended that contaminated soils be removed from beneath the Old Plating Shop concrete slab that will result in residual soil concentrations that are protective to groundwater to a 10^{-4} risk level. Results of Southern Divisions evaluation and selection will be incorporated into the Preliminary Economic Evaluation Report (PEER) that will be incorporated into the CERCLA record for the site under the "Time Critical" path the Navy is following for this interim action.

Should you have any question regarding this matter, please do not hesitate to call Peter Redfern or me at (904) 269-7012.

Very truly yours,
ABB ENVIRONMENTAL SERVICES, INC.

Jesse M. Tremaine
Senior Scientist

cc: Peter Redfern
File

ABB Environmental Services, Inc.

07577-003

1536 Kingsley Avenue
Suite 127
Orange Park, Florida 32073

Telephone (904) 269-7012
Fax (904) 264-5632

Introduction

The interim source reduction action objective for the plating shop is to reduce the contamination in the soil underlying the concrete slab of the Old Plating Shop, thereby reducing the potential for degradation of groundwater quality. The reduction action addressed in this memo is not intended to be the final action at the site, but is an opportunistic action taken as part of the demolition of the above grade structure and portions of the concrete slab at the Old Plating Shop located in Building 101. This area will be further investigated during the overall RI/FS under CERCLA for OU3.

This memorandum presents potential interim soil remediation levels of organic and inorganic constituents that are protective of groundwater. These levels were calculated based on an acceptable cancer risk of 1×10^{-6}, 1×10^{-5} or 1×10^{-4}, or a noncancer hazard quotient of 0.1, 1.0 or 10. Potential contamination of groundwater from soil is the only route of exposure considered, because upon completion of the demolition activities this site will be capped by construction of a new concrete slab and building, thus preventing receptor contact with soil.

Method

Soil samples collected from the plating shop (Ensearch 1994 remediation) were analyzed for the Target Analyte List (TAL) inorganics and Target Compound List (TCL) organics. The maximum concentration for each analyte detected at the Old Plating Shop was compared with the proposed USEPA soil screening levels (SSLs) protective of groundwater. If the concentration detected onsite exceeded the SSL or if there was no analyte-specific SSL available, calculation of a site-specific soil clean-up level protective of groundwater was considered. Other soil concentrations considered as screening levels were soil clean-up levels goals based on leachability developed by the State of Florida (FDEP, 1994), and the maximum concentration of contaminants in TCLP leachate (USEPA, 1993), assuming a 20-fold dilution from soil to leachate. The State of Florida has not derived SSLs for inorganics, but defers to TCLP values. The TCLP values were developed to characterize solid waste relative to land disposal, and are not designed to be protective of human health. Since the goal of this memorandum is to develop source removal recommendations that are protective of human health, the Florida and TCLP screening levels were considered inconsistent with these objectives, and were not used in this evaluation.

Table 1 summarizes the maximum concentration of analytes found onsite and the proposed USEPA screening levels. Based on comparison to the SSLs, potential contamination of groundwater from compounds in soil was considered for constituents with "Yes" in the "Retained" column. Analytes detected for which there were no SSLs, were also retained for further consideration.

The USEPA (1994a) equation presented in Table 2 was used to calculate soil clean-up levels protective of human health associated with ingestion of groundwater. This equilibrium soil/water partition equation describes the ability of contaminants to sorb to organic carbon in soil (Dragun, 1988). It has been adjusted to relate a sorbed concentration in soil to the analytically measured total soil concentration. In the equation, the movement of organic constituents through soil is characterized using the content of organic carbon in soil (foc) and an organic carbon/water partition coefficient (Koc). The mobility of inorganics in soil is more complex and is affected by a number of parameters, most significantly pH. The clean-up levels for inorganics were derived using the equation in Table 2, however inorganic-specific Kd values, modeled over a range of soil pH values (4.9, 6.8, and 8.0) identified by the USEPA (1994b), were used in the equation in place of the Koc x foc parameters. In lieu of site-specific values, non-analyte specific parameters used in the equation are USEPA (1994a) default values.

Table 1
Comparison of Maximum Concentration Detected On-site to Soil Screening Levels Considered Protective of Groundwater

Analytes	Maximum Concentration	USEPA SSL DAF = 10 [1]	Retained?
Metals (mg/kg)			
Aluminum	9550		Yes
Arsenic	3.7	15	No
Cadmium	334	6	Yes
Calcium	31400		No[2]
Chromium	2940	19	Yes
Cobalt	104		Yes
Copper	311		Yes
Iron	16000		No[2]
Lead	442		Yes
Magnesium	2330		No[2]
Manganese	113		Yes
Mercury	0.91	3	No
Nickel	90	21	Yes
Selenium	2.7	3	No
Silver	118		Yes
Thallium	5.5	0.4	Yes
Vanadium	18.1		Yes
Zinc	297	42000	No
Cyanide (mg/kg)	10.2		Yes
Volatile Organic Compounds (mg/kg)			
Acetone	0.2	8	No
2-Butanone	0.018		Yes
Chlorobenzene	0.026	0.6	No
Chloromethane	0.053		Yes
1,2 Dichloroethene	0.017	0.2	No
Ethylbenzene	0.095	5	No
4-Methyl-2-Pentanone	0.053		Yes
Toluene	0.052	5	No
Trichloroethene	0.11	0.02	Yes
Xylene (total)	0.37	74	No

See notes at end of table.

Table 1 (Cont.) Comparison of Maximum Concentration Detected On-site to Soil Screening Levels Considered Protective of Groundwater			
Analytes	Maximum Concentration	USEPA SSL DAF = 10	Retained?
Semi-Volatile Organic Compounds (mg/kg)			
Acenaphthene	0.27	200	No
Anthracene	0.31	4300	No
Benzo (a) anthracene	1.8	0.7	Yes
Benzo (a) pyrene	1.7	4	No
Benzo (b) fluoranthene	2.9	4	No
Benzo (g h i) perylene	1.1		Yes
bis (2-ethylhexyl) phthalate	7	11	No
Butylbenzylphthalate	1.4	68	No
Carbazole	0.49	0.5	No
Chrysene	2.8	1	Yes
Di-n-octyl Phthalate	1.4	14000000	No
Dibenzofuran	0.12		Yes
1,2-Dichlorobenzene	1.3	6	No
Fluoranthene	4.2	980	No
Fluorene	0.16	160	No
Indeno (1 2 3-cd) pyrene	1.2	35	No
Phenanthrene	2.6		Yes
Pyrene	2.9	1400	No

1 DAF = Dilution/Attenuation Factor

2 These compounds are considered essential nutrients and are not considered for soil clean-up.

The target soil leachate concentrations for inorganics and organics are based on acceptable health-based concentrations associated with cancer risk of 1×10^{-6}, 1×10^{-5} or 1×10^{-4}, or a noncancer hazard quotient of 0.1, 1.0 or 10, assuming ingestion of groundwater by an adult as described in RAGS (USEPA, 1989). The one exception to this is the target soil leachate concentration for copper, which is based on the maximum contaminant concentration goal (MCLG) because there is inadequate information for the calculation of a reference dose. Based on the average (arithmetic mean) site-specific pH of 7.8, the Kd values for a pH of 8.0 (USEPA, 1994b) were used to calculate soil clean-up levels for inorganics. Chemical specific Kocs and Henry's Law Constants for organics are from the literature.

Results

Presented in Tables 3 and 4 are potential interim soil remediation levels, considered to be protective of groundwater. These clean-up levels are calculated based on concentrations associated with acceptable cancer risks of 1×10^{-6}, 1×10^{-5} or 1×10^{-4}, or noncancer hazard quotients of 0.1, 1.0 or 10. These levels of risk were chosen because they are indicative of an acceptable level of exposure as defined in the National Contingency Plan (USEPA, 1990). In addition, a cancer risk of 1×10^{-6} or less is considered to be *de minimis*. The range of noncancer hazard quotients chosen are centered around one, a value generally considered to be without deleterious effects, even for sensitive individuals. These interim clean-up levels are sufficient to reduce the potential impact to groundwater from soil, however, further consideration of potential risks and hazards will be addressed in the OU-3 RI/FS.

Table 2
Soil Clean-up Level Partitioning Equation for Migration to Ground Water

$$Soil\ Clean\text{-}up\ Level\ (mg/kg) = C_w\ [K_D + \frac{(\theta_w + \theta_a H')}{\rho_b}]$$

Parameter	Definition	Default	Reference or Equation
C_w	Target soil leachate concentration	Chemical specific (mg/L)	Calculated
K_d	Soil-water partition coefficient	Chemical specific (L/kg)	$K_{oc} \times f_{oc}$ for organics Inorganic-specific K_d
K_{oc}	Soil organic carbon/water partition coefficient	Chemical specific (L/kg)	
f_{oc}	Fraction organic carbon in soil	0.2% (0.002 g/g)	USEPA, 1994a
θ_w	Water-filled soil porosity	0.3	$w \times \rho_b$
w	Average Soil Moisture content	20% (0.2 kg_{water}/ kg_{soil})	USEPA, 1994a
ρ_b	Dry soil bulk density	1.5 (kg/L)	$(1\text{-}n) \times \rho_s$
n	Soil porosity	0.43 (L_{pore}/L_{soil})	USEPA, 1994a
ρ_s	Soil particle density	2.65 (kg/L)	USEPA, 1994a
θ_a	Air-filled soil porosity	0.13 (L_{air} / L_{soil})	$n - \theta_w$
H	Henry's Law Constant	Chemical specific (atm-m^3/mol)	
H'	Henry's Law Constant	Unitless	H x 41, where 41 is a units conversion factor

Please note, the following analytes, copper, lead, 2-butanone, chloromethane, and 4-methyl-2-pentanone, had interim soil remediation levels protective of groundwater calculated because there were no analyte-specific SSLs available for comparison.

The objective of this memo is not to include the quantitative assessment of analytes for which there is inadequate data. This aspect of the risk assessment will be considered as part of the more inclusive RI/FS report prepared under CERCLA for OU3. As a result of this action, soil clean-up levels were not calculated for the following analytes because of the lack of quantitative information to assess partitioning of inorganics in soil:

- aluminum
- cobalt
- manganese
- silver
- vanadium
- cyanide

Additionally, no soil clean-up levels were calculated for benzo(g,h,i) perylene, dibenzofuran or phenanthrene because adequate quantitative toxicity information is not available.

Table 3 Site-Specific Clean-up Levels Protective of Groundwater Based on an Acceptable Range of Cancer Risks				
Compound	Maximum Concentration	1×10^{-6}	1×10^{-5}	1×10^{-4}
Volatile Organic Compounds (mg/kg)				
Trichloroethene	0.11	0.00374	0.0374	0.374
Semi-Volatile Organic Compounds (mg/kg)				
Benzo(a)anthracene	1.8	0.322	3.22	32.2
Chrysene	2.8	0.467	4.67	46.7

Table 4 Site-Specific Clean-up Remediation Levels Protective of Groundwater Based on a Range of Noncancer Hazard Quotients				
Compound	Maximum Concentration	0.1	1	10
Metals (mg/kg) [1]				
Cadmium	334	8.21	82.1	821
Chromium (hexavalent)	2940	0.259	2.59	25.9
Copper	311		37100 [2]	
Lead	442	400 [3]	400 [3]	400 [3]
Nickel	90	10.5	105	1050
Thallium	5.5	0.0281	0.281	2.81
Volatile Organic Compounds (mg/kg)				
2-Butanone	0.018	0.458	4.58	45.8
Chloromethane	0.053	0.00617	0.0617	0.617
4-Methyl-2-Pentanone	0.053	0.0696	0.696	6.96

1 Kd values were available for the following metals: Arsenic, Barium, Beryllium, Cadmium, Chromium (hexavalent), Copper, Mercury, Nickel, Selenium, Thallium, and Zinc (USEPA, 1994b).
2 For copper, a soil clean up level was proposed using the MCLG of 1.3 mg/L.
3 USEPA Office of Solid Waste and Emergency Response (OSWER) Directive #9355.4-12, dated July 14, 1994 interim recommended soil cleanup level at Superfund sites for residential settings.

The equation used to calculate the interim soil remediation levels relates concentrations of contaminants adsorbed to soil organic carbon to soil leachate concentrations in the unsaturated zone. Contaminant migration through the unsaturated zone to the water table and ground water transport in the saturated zone generally reduces the soil leachate concentration. To account for this reduction a DAF or dilution/attenuation factor is applied. The values presented in Tables 3 and 4 are reported assuming there is no attenuation or dilution of the contaminant (i.e., the concentration at the receptor point is equal to the concentration in soil leachate as it leaves the source). A USEPA (1994a) default value of 10, determined by weight of evidence, can be applied, or site-specific value can be calculated using the following mixing zone equation. Application of this DAF will reduce the amount of clean-up necessary at the plating facility.

Maximum concentrations of chromium, cadmium, and thallium were evaluated with regard to soil volumes that would need to be removed depending on the level of protectiveness selected. Interim remediation, based upon these maximum concentrations, would also encompass all other contaminants that would require removal under the different protectiveness scenarios.

Figure 1 illustrates the proposed area of concrete to be removed and the concentrations of chromium, cadmium, and thallium which represent maximum concentrations for these metals at depths ranging from 0-18" to 3-24" below land surface. When these concentrations are evaluated with respects to the varying proposed interim soil remediation levels for the three hazard index of 0.1, 1.0, and 10 (representing risk equal to 10^{-6} to 10^{-4}) the areal extent of soil removal changes significantly.

Figure 2 illustrates the areal extent of soils that would require removal under the three protectiveness scenarios. As indicated by Figure 2, removing soil to the 0.1 and 1.0 hazard index (equal to 10^{-6} and 10^{-5} risk) would require excavation outside the proposed area for concrete removal to the boundary of the soil samples collected. Interim soil remediation to the 10 hazard index (equal to 10^{-4} risk) approximates the proposed concrete removal area and would be supportive of the objective to reduce source contamination for protectiveness of groundwater quality with quantitative evaluation of residual risks being conducted during the RI/FS for OU-3.

Uncertainty

The conceptual model used by the USEPA to develop the guidance used in this memo, is protective for a source area of up to 30 acres. The model also assumes an infinite source, and that the source extends to the water table. Attenuation in the unsaturated zone is not considered, however dilution is assumed within the aquifer to the point of compliance at the edge of the site by applying a default DAF of 10. Because the source being considered here is much smaller than the 30 acres assumed by the USEPA, the default DAF of 10 may be an underestimation of dilution/attenuation. Although, since the area will be capped, the infiltration rate considered in the derivation of the DAF may be small and the default DAF of 10 could be an overestimation. The derivation of a site specific dilution/attenuation factor is recommended, however at this time site-specific values are unavailable.

For the derivation of inorganic soil clean-up levels, Kds modeled for a soil pH of 8.0 were used. For comparative purposes, Table 5 presents soil clean-up levels for hazard quotients of 0.1, 1.0 and 10, calculated using the USEPA Kds modeled for soil pH levels of 6.8 and 8.0 (USEPA, 1994b). Site-specific average pH is 7.8. Comparison of these values indicate that the only metal to be added by a lower site pH would be nickel. However, using the maximum values detected for the various depths for chromium, cadmium, and thallium for remediation extent would encompass nickel contaminated soils.

Table 5
Site-Specific Interim Remediation Levels Protective of Groundwater Based on pH Specific Kds

Compound	Maximum Concentration	HI =0.1		HI = 1		HI = 10	
		pH 6.8	pH 8.0	pH 6.8	pH 8.0	pH 6.8	pH 8.0
Metals (mg/kg)							
Cadmium	334	0.219	8.2	2.19	82.4	21.9	824
Chromium (hexavalent)	2940	0.35	0.259	3.5	2.59	35	25.9
Copper [1]	311	NC	NC	13000	37100	NC	NC
Nickel	90	1.55	10.5	15.5	105	155	1050
Thallium	5.5	0.0208	0.0281	0.208	0.281	2.08	2.81

[1] For copper, a soil clean up level was proposed using the MCL of 1.3 mg/L. NC = not calculated.

It should be noted that the methodology used here has been used by the State of Florida to develop soil clean-up goals based on leachability, however it is still under review by the USEPA. The Kd's proposed for use with the inorganic compounds were submitted for general review in July, along with the soil/water partition equation. This guidance is being used by the USEPA on a pilot basis for remedial investigation/feasibility studies.

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NAS-JAX Plating Shop
Ebasco Environmental
Contract Number N47408-92-D-3059

Soil Sampling Locations

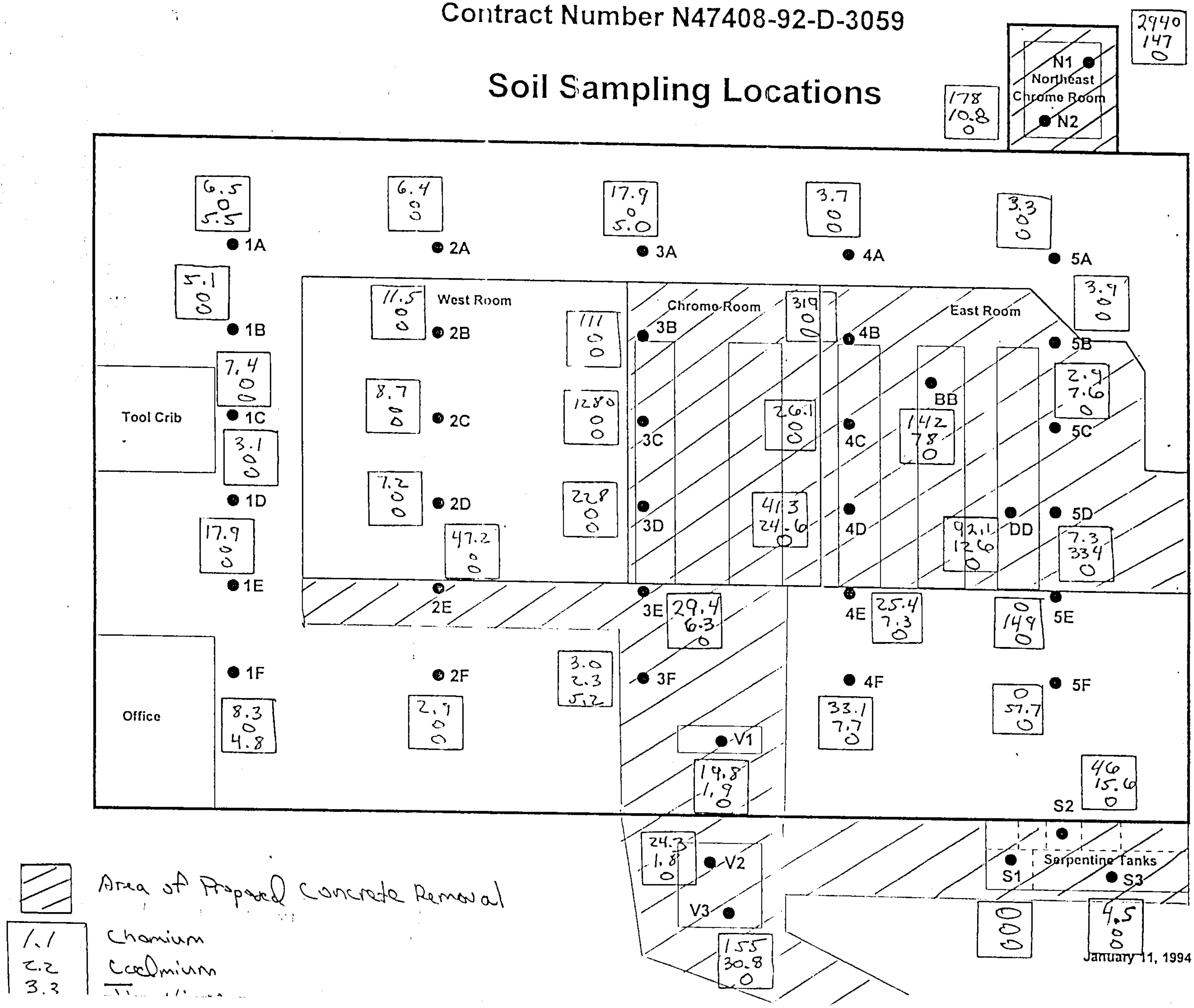

Figure 1

NAS-JAX Plating Shop
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Soil Sampling Locations

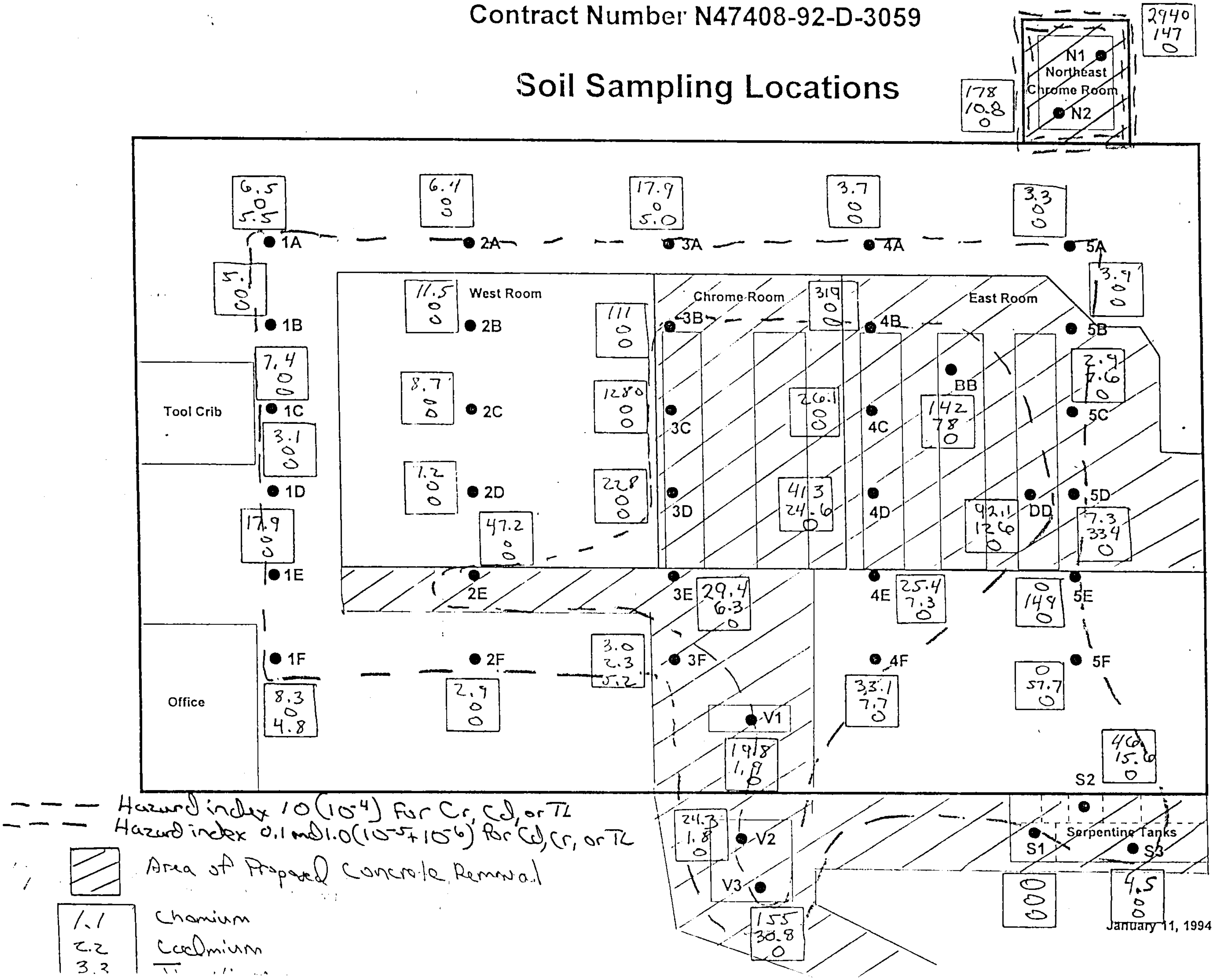

Figure 2

NAS-JAX Plating Shop
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Soil Sampling Results

	1A-1	1A-2	1A-3	2A-1	2A-2	2A-3	3A-1	3A-2	3A-3	4A-1	4A-2	4A-3	5A-1	5A-2	5A-3	1B-1	1B-2	1B-3
Metals (mg/kg)																		
Aluminum	3,520	497	123	1,860/2,830	346	119	3,120	2,210	780	470	407	58.2	1,440	334	955/893	1,220	2,090	126
Calcium	1,360			1,160/1,180			3,070		1,740						1,770/1,940	1,330	2,380	
Chromium	6.5			4.8/6.4			6.5	3.6	17.9		3.7		3.3			3.0	5.1	
Iron	4,050	482	144	2,520/3,320	504	241	2,230	811	575	547	417	178	1,530	443	1,680/2,010	1,950	3,160	158
Lead	6.5	0.76	1.5	4.0/4.4	0.74	1.4	4.8	2.0	2.3	2.3	2.1		5.4	1.0	7.4/7.6	4.1	4.2	1.6
Manganese	19.1		6.8	14.6/18.1	3.2	8.1	23.3	14.3	4.0		5.5		9.6	3.5	20.0/22.7	11.9	14.2	11.1
Mercury			0.13												0.30/0.04			
Selenium		2.7					2.4											
Thallium		5.5					5.0											
Zinc	6.7			4.9/5.6			6.1								8.0/6.9	9.3	10.5	8.0
pH	7.65	4.40	6.90	8.45/8.35	5.35	7.30	8.80	8.05	7.80	8.50	8.20	7.30	9.10	8.10	6.00/6.30	8.45	3.65	6.60
Cyanide (mg/kg)																		
Volatile Organic Compounds (mg/kg)																		
Acetone	0.140			0.024/0.053									0.061	0.016	0.056/0.020 (0.041/0.047)	0.065		
4-Methyl-2-Pentanone														0.015				
Toluene															ND/ND (ND/0.015)			
Semi-Volatile Organic Compounds (mg/kg)																		
Butylbenzylphthalate	0.700																	
Fluoranthene													0.830					
Pyrene													0.640					
Chrysene													0.440					
Benzo (b) fluoranthene													0.500					

NAS-JAX Plating Shop
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Soil Sampling Results

	2B-1	2B-2	2B-3	3B-1	3B-2	3B-3	4B-1	4B-2	4B-3	5B-1	5B-2	5B-3	1C-1	1C-2	1C-3	2C-1	2C-2	2C-3
Metals (mg/kg)																		
Aluminum	3,850		94.6	592	234	104/178	4,750	182	169	511	181	1,970	3,500	222	149	1,120/639	279	65.4
Calcium	1,570									2,350			1,920					
Chromium	7.7		11.5		8.4	96.2/111	75.9	4.2	319			3.9	7.4			2.9/ND		8.7
Copper										7.8								
Iron	4,260	576	110	833	407	129/249	13,500	340	202	995	283	1,980	6,940	396	156	1,590/962	458	106
Lead	5.0	1.0	1.3	5.0	10.1	1.1/1.2	3.1	2.1	1.8	4.3		2.7	5.3	0.8	1.3	2.0/1.6	8.2	1.7
Manganese	28.1		8.7	7.3		10.4/12.2	5.3		6.1	7.5		11.5	17.6		7.5	9.6/7.4		11.4
Mercury										0.44								
Vanadium							18.1						11.5					
Zinc	9.4				4.6			6.3	5.9			9.3	9.6			ND/4.7		
pH	8.30	4.90	5.95	8.20	7.50	6.60/6.95	7.40	7.35	6.30	8.85	7.55	5.90	8.20	5.45	6.60	9.15/8.90	6.05	5.55
Cyanide (mg/kg)																		
Volatile Organic Compounds (mg/kg)																		
Acetone				0.058								0.017				ND/0.018		
Chloromethane				0.053			0.018											
Semi-Volatile Organic Compounds (mg/kg)																		
Benzo (b) fluoranthene																0.410/ND		

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Soil Sampling Results

	3C-1	3C-2	3C-3	4C-1	4C-2	5C-1	5C-2	1D-1	1D-2	1D-3	2D-1	2D-2	2D-3	3D-1	3D-2	3D-3	4D-1	4D-2
Metals (mg/kg)																		
Aluminum	654	1,620	6,980	1,040	1,830	479	1,750/2,020	1,090	251	58.7	3,450	264	124	145	82.9	718/783	596	723
Arsenic											2.5							
Cadmium						1.5	6.8/7.6										6.1	24.6
Calcium	2,570			1,750		6,980					2,830			5,070				
Chromium	742	1,280	246	26.1	3.1	2.9		3.1			7.2		7.1	228	92.5	6.0/4.9	69.4	413
Cobalt				40.3										104				
Copper				65.1										15.0			19.4	10.8
Iron	1,320	790	6,180	16,000	1,310	469	584/673	2,000	367	158	5,220	359	208	4,480	275	576/572	569	898
Lead	22.2	1.5	7.8	5.6	3.6	2.5	2.1/2.3	2.3	2.1	0.8	5.9	2.1	1.2	117	1.3	2.7/2.9	24.3	76.7
Manganese	7.4		5.4	70.8	5.5	6.6		7.2		10.9	26.9		6.4	24.8			5.2	8.6
Nickel				19.2													29.6	21.6
Silver				17.5										4.8			3.0	10.3
Vanadium			17.1															
Zinc				9.4		5.2					12.7	4.2		11.7			6.3	11.1
pH	9.70	7.40	6.65	8.80	6.90	12.30	7.20/6.85	8.80	4.85	5.35	8.50	5.55	6.75	11.10	7.70	7.35/7.30	11.30	9.70
Cyanide (mg/kg)			2.7				1.6/2.8							1.5				
Volatile Organic Compounds (mg/kg)																		
Acetone	0.042	0.038		0.029	0.063	0.200	0.040/0.029	0.027			0.016		/	0.110		0.024/0.068	0.033	0.035
4-Methyl-2-Pentanone						0.017												
Toluene				0.014														
Trichloroethene	0.110															ND/0.049		
Xylene (total)	0.059			0.034										0.028		ND/0.064		
1,2 Dichloroethene																	0.045	0.017
Semi-Volatile Organic Compounds (mg/kg)																		

NAS-JAX Plating Shop
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Soil Sampling Results

Butylbenzylphthalate	1.400																	
Benzo (a) Pyrene				1.000 (1.700)	0.690 (0.930)													

NAS-JAX Plating Shop
Ebasco Environmental
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Soil Sampling Results

	5D-1	5D-2	5D-3	1E-1	1E-2	1E-3	2E-1	2E-2	2E-3	3E-1	3E-2	3E-3	4E-1	4E-2	4E-3	5E-1	5E-2	5E-3
Metals (mg/kg)																		
Aluminum	1,820	167	356	2,450	9,550	865	1,040/383	161	/31	2,730	1,520	1,510	343	185	96.2	449	112/183	456
Arsenic					3.5													
Cadmium	334	62.0	43.8							3.7	5.1	6.3		1.3	7.3		14.9/14.0	149
Calcium	16,800			3,560	3,930	1,380	1,410/1,130			60,500	24,500	26,700						
Chromium	7.3		2.5	5.0	17.9		10.5/47.2	4.7	5.1	10.2	29.4	19.9			25.4			
Copper	311	58.6	80.0								7.1						6.8/7.1	
Iron	2,430	318	2,150	2,340	11,200	1,010	3,180/737	501	,420	1,410	1,460	1,440	608	398	99.6	683	312/356	452
Lead	8.3	1.4	1.5	4.0	7.6	6.6	3.5/1.9	9.0	4.8	61.9	75.4	83.0	1.4		2.3	1.5	0.52/0.65	1.8
Magnesium					1,940					2,330								
Manganese	16.1		17.9	15.9	99.2	7.5	17.0/5.2		6.9	91.8	37.9	36.0	3.7		4.2	5.5		15.3
Mercury			0.34							0.08		0.06						
Nickel	54.2	18.2	58.4			17.3			33.3									
Vanadium					17.8													
Zinc	33.0	14.8		8.7	22.9	10.0	25.7/11.0	5.0	5.4	71.0	40.3	66.0						
pH	8.50	8.30	7.55	8.20	6.50	4.30	8.50/8.85	7.80	5.20	8.40	8.40	8.40	8.40	8.60	8.30	8.90	8.90/8.85	7.40
Cyanide (mg/kg)	10.2	2.3	8.1															
Volatile Organic Compounds (mg/kg)																		
Acetone									0.017		0.023	0.014		0.020				
Toluene																		0.024
Semi-Volatile Organic Compounds (mg/kg)																		
bis (2-ethylhexyl) Phthalate																1.800		

NAS-JAX Plating Shop
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Soil Sampling Results

	1F-1	1F-2	1F-3	2F-1	2F-2	2F-3	3F-1	3F-2	3F-3	4F-1	4F-2	4F-3	5F-1	5F-2	5F-3	BB-1	DD-1
Metals (mg/kg)																	
Aluminum	3,900	309	2,030	1,100	230	139	944	523	403/599	737	200	2,240	371	154	275	126	248
Cadmium							2.3					7.7			57.7	78.0	126
Calcium	3,970			2,570			7,890										
Chromium	8.3		4.9	2.9			3.0			2.7	3.2	33.1				142	92.1
Cobalt				20.8													
Copper				5.4												78.4	59.3
Iron	4,400	547	2,240	2,350	415	205	1,580	597	391/595	911	327	2,430	528	209	237	339	523
Lead	6.0	0.91	3.1	2.0		1.2	11.6	0.66	1.4/1.9	2.5	0.75	4.6	0.87		1.7	33.8	31.5
Manganese	25.8	4.1	8.7	28.3			15.8	11.9	3.4/9.5	8.2		15.1	4.0		4.1	6.1	8.9
Mercury	0.06															0.12	0.06
Selenium	2.6																
Silver				9.0	2.3											13.1	9.5
Thallium	4.8								0.18/5.2								
Zinc	10.1			6.1			7.3			4.2		7.5				276	131
pH	9.00	6.75	7.20	9.00	5.05	6.35	8.35	8.50	8.70/8.75	8.90	8.90	8.25	9.70	10.00	7.70	7.90	8.15
Cyanide (mg/kg)																1.8	10.0
Volatile Organic Compounds (mg/kg)																	
Acetone	0.040			0.025		0.019		0.031					0.012			0.057	0.033
Toluene																	0.012
Trichloroethene																	0.042 (0.026)
2-Butanone																	0.015
Semi-Volatile Organic Compounds (mg/kg)																	
bis (2-ethylhexyl) Phthalate																0.160	7.000

NAS-JAX Plating Shop
Ebasco Environmental
Contract Number N47408-92-D-3059

Soil Sampling Results

	V1-1	V2-1	V2-2	V3-1	V3-2	S1-1	S2-1	S3-1	N1-1	N1-2	N1-3	N2-1	N2-2
Metals (mg/kg)													
Aluminum	1,370	1,100	634	1,590	709	261	404	410	1,040	438/1,610	1,500	7,300	178
Arsenic												3.7	
Barium				50.0									
Cadmium	1.9		1.8	30.8	7.9		15.6		57.6	147/74.3		4.2	10.8
Calcium	1,810	8,880	16,900	11,900	31,400	4,810	5,410	11,900		854/1,410		12,000	
Chromium	19.8	6.0	24.3	155	77.1		46.0	4.5	585	2,940/1,200	1,340	28.0	178
Cobalt	32.0								28.6	12.7/21.6		20.4	
Copper		7.3		99.4	47.3		14.9		116	126/173			22.2
Iron	3,810	931	1,040	12,100	1,270	298	2,120	1,150	1,240	434/2,010	291	9,580	181
Lead	33.4	151	28.0	442	73.8	2.2	85.3	8.7	4.0	2.4/3.0	2.5	18.0	1.7
Magnesium												1,540	
Manganese	32.9	27.6	11.9	113	13.6	4.6	10.4	8.3	13.8	8.3/17.5	8.1	36.9	9.4
Mercury		0.61	0.91	0.58	0.19								0.05
Nickel			32.7	90.0	10.3					2.4/11.5			
Silver	2.8			7.1			25.7		65.4	5.9/117			118
Vanadium												15.8	
Zinc	10.4	55.6	19.0	297	42.2		13.7		15.1	80.4/18.2		20.1	
pH	7.65	8.30	8.45	8.20	8.50	9.60	10.80	10.80	8.25	6.95/7.05	6.70	8.40	6.65
Cyanide (mg/kg)							1.8				5.2		
Volatile Organic Compounds (mg/kg)													
Acetone	0.033					0.021		0.049	0.083	0.026/ND	0.022	0.047	
4-Methyl-2-Pentanone							0.053						
Toluene						0.034	0.052			ND/0.014			
Xylene (total)						0.014	0.370						
Ethylbenzene							0.095						

NAS-JAX Plating Shop
Ebasco Environmental
Contract Number N47408-92-D-3059

Soil Sampling Results

	V1-1	V2-1	V2-2	V3-1	V3-2	S1-1	S2-1	S3-1	N1-1	N1-2	N1-3	N2-1	N2-2
Chlorobenzene											0.026		
2-Butanone	0.018												
Semi-Volatile Organic Compounds (mg/kg)													
Fluoranthene			1.400	4.200	0.960							0.860	
Pyrene			2.200	2.900	1.300							0.900	
Chrysene			1.900	2.800	0.790							0.610	
Benzo (b) fluoranthene			2.900	2.800	1.200							0.840	
Benzo (a) pyrene	0.370		1.400	1.600	0.510							0.390	
bis (2-ethylhexyl) Phthalate				3.000									
Di-n-octyl Phthalate						1.400							
Benzo (a) Anthracene			1.500	1.800	0.600							0.540	
1,2-Dichlorobenzene										ND/1.300			
Dibenzofuran				0.120									
Fluorene				0.160									
Anthracene				0.310									
Carbazole				0.490									
Phenanthrene				2.600	0.800							0.570	
Acenaphthene				0.270									
Indeno (1 2 3-cd) pyrene			0.720	1.200	0.420								
Benzo (g h i) perylene			0.750	1.100	0.520								

APPENDIX C

VOLUME CALCULATIONS FOR SOURCE REDUCTION REMEDIATION

BUILDING 101, NAVAL AIR STATION JACKSONVILLE
OLD PLATING SHOP
VOLUME CALCULATIONS FOR SOIL REMOVAL

The dimension used to calculate the surface area and associated volume are based on the map shown in Figure C-1. A constant depth of three feet was also assumed.

AREA = THE SUM OF THE AREAS FOR GEOMETRIC FIGURES A THROUGH N

AREA A	= 55' x 70' = 3850 ft^2
AREA B	= 0.5 x 5'x 15' = 37.5 ft^2
AREA C	= 15' x 37.5' = 562.5 ft^2
AREA D	= 0.5 x 37.5' x 5' = 93.75 ft^2
AREA E	= 0.5 x 27.5' x 20' = 275 ft^2
AREA F	= 0.5 x 16' x 25' = 200 ft^2
AREA G	= 0.5 x 12.5' x 50 = 312.5 ft^2
AREA H	= 0.5 x 25' x 11.25' = 140.625 ft^2
AREA I	= 0.5 x 10' x 27.5' = 137.5 ft^2
AREA J	= 22.5' x 10' = 225 ft^2
AREA K	= 0.5 x 2.5' x 22.5' = 28.125 ft^2
AREA L	= 0.5 x 7.5' x 10' = 37.5 ft^2
AREA M	= 0.5 x 17.5' x 45' = 393.75 ft^2
AREA N	= 0.5 x 2.5' x 52.5' = 65.625 ft^2
TOTAL AREA	= 6359.37 ft^2

TOTAL VOLUME	= AREA x 3 ft depth
VOLUME	= 6359.37 ft^2 x 3 ft = 19078.125 ft^3
VOLUME	= approximately 700 yd^3

Therefore, for all calculations involving the volume of soil to be removed based on a risk of 10^{-4}, 700 cubic yards will be used.

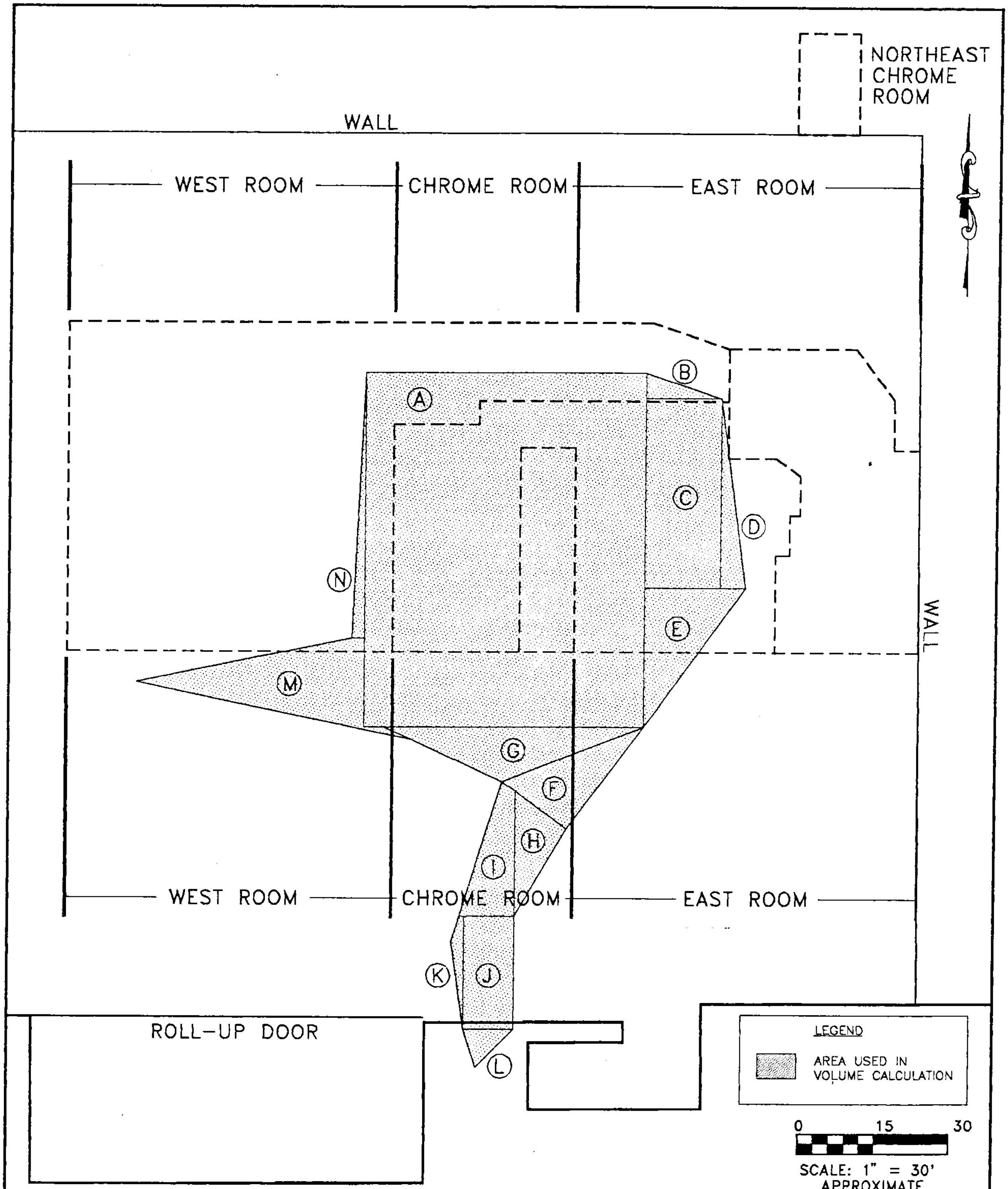

FIGURE C-1
AEREAL EXTENT OF VOLUME CALCULATION

PRELIMINARY ECONOMIC EVALUATION REPORT FOR SOIL CONTAMINANT REDUCTION, BUILDING 101
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

/DWGS/OU3/B101/DRM/12-22-94

APPENDIX D

COST ESTIMATE FOR SELECTED ALTERNATIVE

BUILDING 101, NAVAL AIR STATION JACKSONVILLE
OLD PLATING SHOP
COST ESTIMATE FOR SOIL REMOVAL

ASSUMPTION

The cost estimates are based on the following assumptions:

- 1 to 3 months, using a 2 month average with 45 working days
- 10 hour days
- 700 yd^3 of soil to be removed
- 600 mile to the offsite treatment and RCRA subtitle C landfill

DESCRIPTION OF ACTIVITIES

Site preparation: This includes obtaining permits, locating and stacking utilities, placements of temporary fencing and warning signs to sufficiently limit access to the excavation, and mobilization of necessary equipment.

Excavation for offsite treatment and disposal: The area will be excavated using a backhoe with the soil being transferred into leak-proof trucks for transportation to the offsite treatment and disposal facility. Soil will be treated using offsite stabilization technologies with final disposal in a RCRA subtitle C landfill. It may be necessary to sample and analyze the waste before disposal.

Demobilization and site restoration: Once excavation is completed, site restoration will include: backfilling the excavated area with a clean fill material compacted to sufficient load bearing strength, removal of temporary fencing and warning signs, demobilization of equipment, and clean-up of the decontamination area.

COST ESTIMATE

Site preparation	\$15,000
Permitting and regulatory compliance	\$7,000
Equipment	
• Backhoe (\$6,000/month)	\$12,000
• Dumptruck (3 trucks at \$2,900/month)	\$17,400
• Truck scale (\$1,300/month)	\$2,600
• Miscellaneous equipment (\$3,700/month)	\$7,400
• Personnel health and safety equipment (\$4,600/month)	\$9,200
• Decontamination equipment (\$650/month)	\$1,300
• Compaction equipment (\$5,000/month)	\$10,000
Analytical Services	\$12,000
Labor	
• Process operators (4 at \$45/hr)	\$81,000
• Field support (3 at \$45/hr)	\$60,750
• Project superintendent (1 at \$60/hr)	\$27,000
• Health and safety officer (1 at \$60/hr)	\$27,000
• Offsite support (2 at \$45/hr)	\$40,500
• Security (1 at \$25/hr)	\$11,250
• Per diem (9 at \$65/day)	\$26,325
• Home leave (9 at \$600/month)	\$10,800
• Training	\$6,000
Utilities	\$7,000
Facility modifications, repair, replacement	\$3,000
Site Demobilization and restoration	\$1,500
Treatment and disposal of soil (at \$85/yd_3)	\$59,500
Transportation (\$3.00/mile/20 ton load)	\$63,000
SUBTOTAL	**\$518,525**
Contingency (20% of subtotal)	\$103,705
Profit (10% of subtotal plus contingency)	\$62,223
TOTAL	**\$684,453**